PART IV

NAS ARCHITECTURE SUMMARY

33 NAS ARCHITECTURE SUMMARY

NAS users and the FAA defined the future operations of the NAS in the *Joint Government/Industry Operational Concept for the Evolution of Free Flight.* This concept of operations, which is the foundation of the architecture, is consistent with the FAA's Air Traffic Services (ATS) *A Concept of Operations for the National Airspace System in 2005*.

This architecture is an evolutionary plan for modernizing the NAS and moving towards Free Flight. It incorporates new technologies, procedures, and concepts intended to meet the needs of NAS users and service providers. It includes schedules for the various NAS components, aligned to the expected funding levels indicated by the FAA's in January 1998 funding projections through 2015. The architecture is designed to provide *all* airspace users with more flexible and efficient operations.

The NAS architecture describes changes to the NAS in communications, navigation, surveillance, automation tools, and avionics designed to improve NAS operations and services. Specific details contained in this architecture include:

- Description of NAS capabilities
- Enabling technologies, including their interdependencies
- Research and development required for new technology and procedures
- Transition schedules for functional enhancements
- Projected costs for the FAA and users.

The NAS architecture is divided into three implementation phases, from 1998 to 2015:

- *Phase 1 (1998–2002):* Focuses on sustaining essential air traffic control services and delivering early user benefits; satellite-based navigation systems will be deployed and air-air surveillance will be introduced
- *Phase 2 (2003–2007):* Concentrates on deploying the next generation of communications, navigation, and surveillance (CNS) equipment and the automation upgrades necessary to accommodate new CNS capabilities
- *Phase 3 (2008–2015):* Completes the required infrastructure and integration of automation advancements with the new CNS technologies that enable additional Free Flight capabilities throughout the NAS.

The architecture will continue to be updated, and numerous factors can and will change it. Results of investment analyses will immediately be factored into the NAS Architecture data base and may affect individual program costs. Research continues to identify new technologies that could affect cost and the timing of improvements. Funding levels may have a major impact on both the timing and extent of NAS modernization. Because this architecture takes an integrated view, any individual program slip can affect other programs and eventually lead to changes in delivery time of new capabilities.

The FAA intends to use the architecture in several important ways. The agency will support the annual budget process by prioritizing funding levels of programs critical to modernization and the sustainment of legacy systems. The architecture provides alternative investment analysis starting points for new systems.

The architecture is the FAA's public commitment to modernize the NAS consistent with budgets and good management. Most importantly, the architecture forms the basis for continuing discussions and planning with the aviation industry and users. It provides the aviation industry a tool for planning the avionics upgrades that complement the new technologies and procedures envisioned for Free Flight.

This architecture estimates the time required for changing FAA regulations and certification procedures, for hardware development, and for users to equip with appropriate avionics. Reasonable assumptions have been made about the rate at which users will equip with new avionics. However, the marketplace greatly influences the aviation industry and is one factor that could affect equipage rates.

It is extremely difficult to accurately predict system performance levels when so many new technologies are being introduced at once. However, safety remains a primary consideration in mod-

ernizing the NAS and determining if/when new services will become available to users. With time, understanding of new technologies and their human factors implications will become clearer. This understanding could alter the concept of operations (CONOPS) and the architecture.

This NAS architecture would not have been possible without the help and guidance of the entire user community. The continued involvement of RTCA, the International Civil Aviation Organization (ICAO), and the Core Team is vital to shaping the future of the NAS. The FAA intends to reach new levels of trust and cooperation with NAS users, with the goal of providing the safest, most cost-effective, and efficient airspace system in the world.

PART V

APPENDIXES

APPENDIX A

LIST OF ACRONYMS AND ABBREVIATIONS

LIST OF ACRONYMS AND ABBREVIATIONS

Bolded listings are FAA organizations.

A/A	air-air
A/G	air-ground
A/N	alphanumeric
AAF	Airway Facilities Service (FAA organization)
AAT	Air Traffic (FAA organization)
AATS	airspace analytical tool system
ABPE	automated barometric pressure entry
ACARS	Aircraft Communications Addressing and Reporting System
ACE	ASOS controller equipment
ACO	Aircraft Certification Office
ACS	Civil Aviation Security (FAA organization)
ADAS	AWOS data acquisition system
ADDS	Aviation Digital Data Service
ADF	automatic direction finder
ADS	automatic dependent surveillance
ADS-A	automatic dependent surveillance addressable
ADS-B	automatic dependent surveillance broadcast
ADSS	ATC decision support system
ADTN 2000	Administrative Data Transmission Network 2000
AERA	automated en route air traffic control
AF	Airway Facilities (FAA organization)
aFAST	active Final Approach Spacing Tool
AFB	air force base
AFOS	automation of field operations and services
AFSS	automated flight service station
AFTN	aeronautical fixed telecommunications network
AGATE	advanced general aviation transport equipment
AGFS	Aviation Gridded Forecast System
AIA	automated interface adapter
AIDC	air traffic services interfacility data communications
AIM	Airman’s Information Manual
AIP	Airport Improvement Program
AIRMET	airman's meteorological information
AIS	aeronautical information system
ALDARS	ASOS Lightning Detection and Reporting System
ALSF	approach lighting system with sequenced flashing lights
AM	amplitude modulation

AMASS	Airport Movement Area Safety System
AMS	acquisition management system
AMSS	aeronautical mobile satellite service
ANC	Air Navigation Commission
ANICS	Alaska NAS Interfacility Communications System
ANSI	American National Standards Institute
AOA	air operations area
AOAS	Advanced Oceanic Automation System
AOC	airline operations center
AOCNet	airline operations center network
AOS	Operational Support Services (FAA organization)
APB	acquisition program baseline
API	Policy, Planning and International Aviation (FAA organization)
APP	application portability profile
ARA	Research and Acquisition (FAA organization)
ARP	Airports (FAA organization)
ARSR	air route surveillance radar
ARTCC	air route traffic control center
ARTCC-P	Air Route Traffic Control Center Personnel
ARTS	automated radar terminal system
ASAS	Aviation Safety Analysis System
ASD	aircraft situation display
ASDE	airport surface detection equipment
ASDI	aircraft situation display to industry
ASIS	aviation standards information system
ASM	altimeter setting message
ASOS	automated surface observing system
ASR	Office of Spectrum Policy and Management (FAA organization)
ASR	airport surveillance radar
ASR-WSP	airport surveillance radar-weather system processor
ASRP	Aviation Safety Research Program
AST	Commercial Space Transportation (FAA organization)
ASTERIX	All Purpose Structural Eurocontrol Radar Information Exchange
AT	Air Traffic (FAA organization)
ATC	air traffic control
ATCBI	air traffic control beacon interrogator
ATCRBS	air traffic control radar beacon system
ATCSCC	Air Traffic Control System Command Center
ATCT	airport traffic control tower

ATCT-P	Airport Traffic Control Tower Personnel
ATIS	automatic terminal information service
ATM	air traffic management
ATN	aeronautical telecommunications network
ATOMS	Air Traffic Operational Management System
ATS	Air Traffic Services (FAA organization)
AVN	Aviation System Standards (FAA organization)
AVR	Regulation and Certification (FAA organization)
AW-IDS	automated weather information distribution center
AWC	Aviation Weather Center
AWN	Automated Weather Network
AWOP	All Weather Operations Panel
AWOS	automated weather observing system
AWP	aviation weather processor
AWR	Aviation Weather Research
B	billion
BD	begin decommission
bps	bits per second
BRI	basic rate interface
BUEC	backup emergency communications
CA	conflict alert
CAA	Cargo Airline Association
CAASD	Center for Advanced Aviation System Development
CAEG	computer aided engineering graphic
CAMI	Civil Aeromedical Institute
CARF	central altitude reservation function
CASA	Controller Automation Spacing Aid
CAT	category
CBA	cost-benefit analysis
CCLD	core capabilities limited deployment
CDC	computer display channel
CDM	collaborative decisionmaking
CDTI	cockpit display of traffic information
CENRAP	Center Radar ARTS Presentation
CEQ	Council on Environmental Quality
CERAP	Center Radar Approach Control
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act

CERFA	Community Environmental Response Facilitation Act
CFIT	controlled flight into terrain
CFR	Code of Federal Regulations
CFWARP	central flow WARP
CHI	computer-human interface
CIMS	corporate information management system
CM	conflict monitor
CMA	context management application
CMU	communications management units
CNS	communications, navigation, surveillance
CODAS	Consolidated Operations and Delay Analysis System
CONOPS	concept of operations
CONUS	continental United States
COPS	Cost Performance System
COTS	commercial off-the-shelf
CP	conflict probe
CPDLC	controller-pilot data link communications
CR	conflict resolution
CRDA	Converging Runway Display Aid
CSMA	carrier-sense multiple access
CTA	control by time of arrival
CTAS	Center TRACON (terminal radar approach control) Automation System
CTS	coded time source subsystem
CWSU	center weather surface unit
D-ATIS	digital automated terminal information services
D-Side	data side
DA	descent advisor
DAB	David A. Baker
DARC	direct access radar channel
DARP	dynamic air route planning
DASI	digital altimeter setting indicator
DBMS	data base management system
DBRITE	digital bright radar indicator tower equipment
DCCR	display channel complex replacement
DDC	direct digital connect
DDS	digital data service
DDTC	data delivery of taxi clearance
DEDS	data entry and display subsystem

DEMVAL	demonstration validation
DL	data link
DLAP	Data Link Applications Processor
DME	distance measuring equipment
DMN	data multiplexing network
DOD	Department of Defense
DOT	Department of Transportation
DOTS	Dynamic Ocean Tracking System
DOTS + (Plus)	Dynamic Ocean Tracking System Plus
DPAT	detailed policy analysis tool
DSM	display system monitor
DSR	display system replacement
DSS	decision support system
DUAT	direct user access terminal
DVFR	defense visual flight rules
E&M	ear and mouth
E-IDS	enhanced next-generation information display system
EA	environmental assessment
EARTS	En Route Automated Radar Tracking System
EDC	early display configuration
EDDA	Environmental Due Diligence Audit
EEAS	enhanced en route automation system
EFIS	electronic flight information system
EIS	environmental impact statement
ELT	emergency locator transmitter
EMC	Environmental Modeling Center
ENET	enterprise network
EOSL	end of service life
ERDI	en route domain infrastructure
ESI	enhanced DARC system interface
ETAS	enhanced terminal automation system
ETMS	enhanced traffic management system
ETN	electronic tandem network
ETVS	enhanced terminal voice switch
EVCS	Emergency Voice Communications System
F&E	facilities and equipment
FAA	Federal Aviation Administration

FAAHQ-P	Federal Aviation Administration Headquarters Personnel
FAALFI-P	Federal Aviation Administration Logistics Flight Inspection Personnel
FAATSAT	FAA telecommunications satellite
FAATC	FAA Technical Center
FANS	Future Air Navigation System
FAR	Federal Aviation Regulation
FAST	Final Approach Spacing Tool
FBWTG	FAA bulk weather telecommunications gateway
FDADS	fully digital ARTS display system
FDIO	Flight Data Input/Output
FDM	flight data management
FDP	flight data processor
FFP1 CCLD	Free Flight Phase 1 Core Capabilities Limited Deployment
FFTS	full fidelity training simulator
FICS 21	FAA Integrated Communications System for the 21st Century
FID	flight information display
FIR	flight information region
FIS	flight information service
FL	flight level
FM	frequency modulation
FMA	Final Monitor Aid
FMC	flight management computer
FMS	flight management system
FO	flight object
FOC	full operating capability
FOS	family of services
FP	flight plan
FPS	fixed position surveillance
FRAD	frame relay access device
FSAS	flight service automation system
FSC	final system capability
FSD	full-scale deployment
FSDPS	Flight Service Data Processing System
FSL	Forecast Systems Laboratory
FSM	flight schedule monitor
FSS	flight service station
FSS-P	Flight Service Station Personnel
FTS	Federal Telecommunications System

G/G	ground-ground
GA	general aviation
GAO	General Accounting Office
GDP	ground delay program
GEO	geostationary
GEOSAT	geostationary satellite
GICB	ground-initiated communications broadcast
GIS	Geographic Information System
GLONASS	Global Navigation Satellite System
GNSS	Global Navigation Satellite System
GNSSP	Global Navigation Satellite System Panel
GPRA	Government Performance and Results Act
GPS	Global Positioning System
GPWS	ground proximity warning system
GSA	General Services Administration
GUI	graphic user interface
GWDS	graphic weather display system
HARS	high-altitude route system
HCS	host computer system
HF	high frequency
HFDL	high frequency data link
HID	host interface device
HOCSR	Host/oceanic computer system replacement
Host	host computer
HQ	headquarters
HSI	human-system integration
HVAC	heating, ventilation, and air conditioning
H/W	hardware
IAP	instrument approach procedures
IAPA	instrument approach procedures automation
IAIPT	interagency air traffic management integration product team
IC	initial contact
ICAO	International Civil Aviation Organization
ICE-MAN	integrated computer environment–mainframe and networking
ICP	initial conflict probe
ICSS	Integrated Communications Switching System
IDS	Information Display System

IEEE	Institute of Electrical and Electronics Engineers
IF	interface
IFQA	integrated flight quality assurance
IFR	instrument flight rules
IGWDS	Interim Graphic Weather Display System
ILS	instrument landing system
IMC	instrument meteorological condition
IMCS	interim monitoring and control system
INFOSEC	information security
INS	inertial navigation system
IOC	initial operating capability
IP	Internet protocol
IPS	Internet protocol standards
IPT	integrated product team
IRM	information resources management
ISC	initial system capability
ISD	interim situation display
ISDN	Integrated Services Digital Network
ITMRA	Information Technology Management and Reform Act of 1996
ITSC	International Training Services Center
ITWS	Integrated Terminal Weather System
JRC	Joint Resources Council
KBps	kilobytes per second
kHz	kilohertz
LAAS	Local Area Augmentation System
LAN	local area network
LCCE	life-cycle cost estimate
LDRCL	low-density radio communications link
LEO	low earth-orbiting
LIDS	legacy information distribution system
LINCS	Leased Interfacility NAS Communications System
LIS	logistics inventory system
LIU	local interface unit
LLWAS	Low-Level Windshear Alert System
LOC	localizer
Loran-C	Long Range Navigation-C System

LRR	long-range radar
M	million
M&C	monitoring and control
MAR	Managed Arrival Reservoir Program
MC	multicenter
M1FC	Model 1 Full Capacity
MALSR	medium-intensity approach lighting system with runway alignment indicator lights
MARS	managed arrival reservoir
MASPS	minimum aviation system performance standards
MASS	maintenance automation system software
MBO (AIS)	military base operations (aeronautical information system)
MCC	maintenance control center
MCI	Mode-C intruder
MDCRS	Meteorological Data Collection and Reporting System
MDT	maintenance data terminal
MED	managed evolutionary development
MEO	medium earth-orbiting
MFD	multifunctional display
MHz	megahertz
MicroEARTS	Microprocessor En Route Automated Radar Tracking System
MIGFA	machine intelligent gust front algorithm
MIT/LL	Massachusetts Institute of Technology/Lincoln Laboratory
MLS	microwave landing system
MMAC	Mike Monroney Aeronautical Center
MMS	maintenance management system
MNS	mission need statement
Mode-S	Mode-Select (secondary radar discretely addressable mode with data link)
MOPS	minimum operational performance standard
MOU	memorandum of understanding
MPAR	multipurpose airport radar
MPS	maintenance processor subsystem
MSAW	minimum safe altitude warning
MSN	message switch network
NADIN	National Airspace Data Interchange Network
NAIMS	National Airspace Information Monitoring System
NAS	National Airspace System
NASMAP	NAS management automation program

NAS RD	NAS Requirements Document
NASA	National Aeronautics and Space Administration
NASDAC	NAS Data Analysis Center
NASPAS	NAS Performance Analysis System
NATCA	National Air Traffic Controllers Association
Navaid	navigation aid
NCAR	National Center for Atmospheric Research
NCEP	National Center for Environmental Prediction
NDB	nondirectional beacon
NDI	nondevelopmental item
NEPA	National Environmental Policy Act
NESDIS	National Environmental Satellite, Data, and Information Service
NEXCOM	next-generation air-ground communications system
NEXRAD	next-generation weather radar
NIC	network interface card
NIM	NAS infrastructure management
NIS	NAS-Wide Information System
NIST	National Institute of Standards and Technology
NLDN	National Lightning Detection Network
NMAC	near midair collision reports
NMCC	National Maintenance Coordination Center
nmi	nautical mile
NMS	NAS management subsystem
NNCC	national network control center
NOAA	National Oceanic and Atmospheric Administration
NOCC	national operations control center
NOPAC	North Pacific Ocean
NORAD	North American Aerospace Defense Command
NOTAM	notice to airmen
NPIAS	National Plan of Integrated Airport Systems
NPF	NIM premier facility
NPR	National Performance Review
NRC	National Research Council
NRP	National Route Program
NSF	National Science Foundation
NSSL	National Server Storms Laboratory
NTSB	National Transportation Safety Board
NWS	National Weather Service
NWSTG	NWS telecommunications gateway

OAG	Official Airline Guide
OASIS	Operational and Supportability Implementation System
OATS	Office Automation Technology Services
OCC	operations control center
OCS	offshore computer system
OCS-R	offshore computer system rehost
ODAPS	Oceanic Display and Planning System
ODID	operational display and input development
ODL	oceanic data link
ODMS	Operational Data Management System
OE/AAA	obstruction evaluation/airspace and airport analysis
OFDPS	Offshore Flight Data Processing System
OMB	Office of Management and Budget
OPI	office of primary interest
OPS	operations
ORD	operational readiness demonstration
ORMT	Operations Resource Management Team
OS&H	occupational safety and health
OSO	Office of System Operations
OTMS	Oceanic Traffic Management System
P^3I	preplanned product improvement
PABX	public automatic branch exchange
PAMRI	peripheral adapter module replacement item
PAPI	precision approach path indicator
PASS	Professional Airways Systems Specialists (union)
PBX	private branch exchange
PCB	polychlorinated biphenyl
PCB&T	Personnel, Compensation, Benefits and Travel
PDC	predeparture clearance
PDE-P	Planning, Development, and Evaluation Personnel
PDM	predefined message
PDT	product development team
pFAST	passive final approach spacing tool
PFC	Passenger Facility Charge
PIDP	Programmable Indicator Processor
PIREP	pilot report
PMCS	programmable modular communications system

PNIM	prototype NIM
PPS	precise positioning service
PPSS	Portable Performance Support System
PRI	primary rate interface
PRM	parallel runway monitor
PSN	packet switch network
PVD	plan view display
R-side	radar side
RADS	radar and alphanumeric display subsystem
RAIM	receiver autonomous integrity monitoring
RCAG	remote communications air-ground
RCE	radio control equipment
RCL	radio communications link
RCOM	recovery communications
RD	Requirements Document
RDA	radar data acquisition
RDP	radar data processing
RDVS	rapid deployment voice switch
R,E&D	research, engineering, and development
REDAC	Research, Engineering, and Development Advisory Committee
REGIS	Regional Information Service
REQIS	requirements information system
RFDP	replacement flight data printers
RGCSP	Review of the General Concept of Separation Panel
RIR	runway incursion reduction
RMC	Resource Management Council
RMMS	remote maintenance monitoring system
RMS	remote maintenance sensor
RNAV	area navigation
RNP	required navigation performance
ROCC	regional operational command center (NORAD)
RPG	radar product generator
RTA	required time of arrival
RTCA	RTCA, Incorporated
RTR	radio transceiver
RVR	runway visual range
RVSM	reduced vertical separation minima

SAIDS	Systems Atlanta Information Display System
SAMS	special use airspace management system
SAR	search and rescue
SARP	standard and recommended practices
SATCOM	satellite communications
SAT NAV	satellite navigation
SC	single center
SDP	surveillance data processor
SEOAT	System Engineering Operational Analysis Team
SFO	San Francisco International Airport
SI	selective interrogation
SIAP	standard instrument approach procedures
SIGMET	significant meteorological information
SLEP	service life extension program
SLIM	software life-cycle model
SMA	Surface Movement Advisor
SMO	system maintenance and operations
SMS	surface management system
SOC	service operations center
SPAS	Safety Performance Analysis Subsystem
SSC	system service component
SSR	secondary surveillance radar
STAR	space transportation analysis and research
STARS	Standard Terminal Automation Replacement System
STC	supplemental type certificate
STDMA	self-organized time division multiple access
STVS	small tower voice switch
SUA	special use airspace
S/W	software
TACAN	tactical air navigation
TAWS	Terrain Alert and Warning System
TCA	two-controller access
TCAS	Traffic Alert and Collision Avoidance System
TCW	terminal controller workstation
TDLS	tower data link services
TDSS	TFM Decision Support System
TDW	tower display workstation
TDWR	terminal Doppler weather radar

TERP	terminal instrument procedures
TFM	traffic flow management
TIS	Traffic Information Service
TMA	Traffic Management Advisor
TMA MC	Traffic Management Advisor Multicenter
TMA SC	Traffic Management Advisor Single Center
TMC	traffic management coordinator
TML	television microwave link
TMS	traffic management specialist
TMU	traffic management unit
TOC	transfer of communications
TP	telecommunications processor
TRACON	terminal radar approach control
TRM	technical reference model
TSO	technical standard order
TWDL	two-way data link communications
TWIP	Terminal Weather Information for Pilots
TWS	Terminal Weather Service
U.S.	United States
U.S.C.	United States Code
UAT	universal access transceiver
UHF	ultra high frequency
URET CCLD	User Request Evaluation Tool core capabilities limited deployment
VASI	visual approach slope indicator
VDL	very high frequency digital link
VFR	visual flight rules
VHF	very high frequency
VOR	VHF omnidirectional range
VORTAC	VOR co-located with TACAN facilities
VPD	vehicle/pedestrian deviation
VPN	virtual private network
VSCS	voice switching and control system
VSRS	Voice Switch Replacement System
WAAS	Wide Area Augmentation System
WAN	wide area network
WARP	weather and radar processor

WC	work center
WIC	weather in the cockpit
WIS	Workload Information System
WJHTC	William J. Hughes Technical Center
WMSCR	weather message switching center replacement
WS	workstation
WSDDM	weather support to de-icing decisionmaking
WSP	weather system processor
WV	Wake Vortex
Wx	weather
WxP	weather processor
Y2K	Year 2000
ZAN	Anchorage ARTCC
ZHN	Honolulu ARTCC
ZSU	San Juan ARTCC

APPENDIX B

PARTICIPATING ORGANIZATIONS

PARTICIPATING ORGANIZATIONS

The NAS architecture was developed during 1997 and 1998, with the participation of internal FAA and external organizations. This appendix provides a list of those organizations whose contribution or support was instrumental to the development of the NAS architecture. This appendix is not a complete list of participating organizations but provides an indication of the scope of involvement. The routing symbols by each organization identify the unique organizations that supported the architecture development.

Internal FAA Organizations

System Safety Office - ASY

Associate Administration for Policy, Planning, and International Aviation

- Office of Aviation Policy and Plans - APO
- Office of Environment and Energy - AEE
- Office of International Aviation - AIA

Associate Administrator for Commercial Space Transportation - AST

Associate Administrator for Administration

- Office of Business Information and Consultation - ABC
- Office of Financial Services - ABA
- Office of Human Resources Management - AHR

Associate Administration for Airports

- Office of Airport Planning and Programming - APP
- Office of Airport Safety and Standards - AAS

Associate Administrator for Civil Aviation Security

- Office of Civil Aviation Security Policy and Planning - ACP
- Office of Civil Aviation Security Operations - ACO

Associate Administration of Regulation and Certification

- Aircraft Certification Service - AIR
- Flight Standards Service - AFS

Associate Administration for Air Traffic Services

- Director Air Traffic Services
  - Air Traffic Airspace Management - ATA
  - Air Traffic Operations Program - ATO
  - Air Traffic Resource Management Program - ATX
  - Air Traffic Systems Requirements Service - ARS
    - Requirements Development Program - ARR
    - Plans and Performance - ARX
- Director Airway Facilities Service
  - NAS Operations Program Directorate - AOP
  - Resource Management Directorate - AFZ

NAS Transition and Implementation - ANS
Operations Support Service - AOS
Spectrum Policy and Management - ASR
Aviation System Standards - AVN

Office of System Capacity - ASC

Associate Administration for Research and Acquisition

Office of Acquisitions - ASU
Office of Air Traffic Systems Development - AUA
Office of Aviation Research - AAR
Office of Business Management - ABZ
Office of Communications Navigation, and Surveillance Systems -AND
Office of Information Technology - AIT
Office of System Architecture and Investment Analysis - ASD
William J. Hughes Technical Center - ACT
Office of Free Flight Phase 1

Mike Monroney Aeronautical Center - AMC

FAA Academy - AMA
FAA Logistics Center - AML

External Organizations

SETA (System Engineering and Technical Assistance contractor (TRW, ARINC, CTA, NYMA, RMS, SAIC, JTA, PMA))

CSSI

MITRE Corporation/Center for Advanced Aviation System Development (CAASD)

Massachusetts Institute of Technology (MIT)

RTCA and participating members

Research, Engineering, and Development Advisory Committee

Department of Defense

Department of Transportation

APPENDIX C

LIST OF REFERENCES

AND

SUPPLEMENTAL MATERIAL

LIST OF REFERENCES AND SUPPLEMENTAL MATERIAL

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APPENDIX D

NAS CAPABILITIES AND MATRIX

TABLE OF CONTENTS

NAS CAPABILITIES

D.1 NAS Capabilities Diagrams

1. Increased Navigation/Landing Position Accuracy and Site Availability, Air Traffic Services, Arrival/Departure

Figures D-1 and -2 show Phases 1 and 2, respectively, of this capability.

Phase 1 (1998–2002)

- Improved position accuracy is obtained by using range and time data from the Global Positioning System (GPS) as well as GPS correction and integrity information (Wide Area Augmentation System (WAAS)). GPS correction and integrity information from ground systems (WAAS) is relayed through satellites to ensure the signal in space will provide coverage for aircraft at various altitudes. The aircraft's location is displayed to pilots. GPS equipment and GPS augmentation enhance aircraft area navigation (radionavigation) capability for point-to-point flight routes.
- Improved precision approach capability using satellite-based navigation instrument approaches allows precision approaches to category (CAT) I minima at more airports. Satellite-based navigation instrument approaches allow multiple approach paths to many runways. The existing instrument landing systems remain in place during this period.
- Runway and approach lighting systems continue to provide the visual transition from cockpit instrumentation to visual landing during touchdown and rollout. Airport lighting remains a key element to sustaining flight operations during reduced visibility conditions.
- Provides WAAS precision approaches to airports that currently have existing CAT I or other approaches. Actual approach minima will continue to be based on obstacle clearance, lighting, etc.
- Provides WAAS precision approaches to airports that currently do not have precision approaches. Actual approach minima will continue to be based on obstacle clearance, lighting, etc.

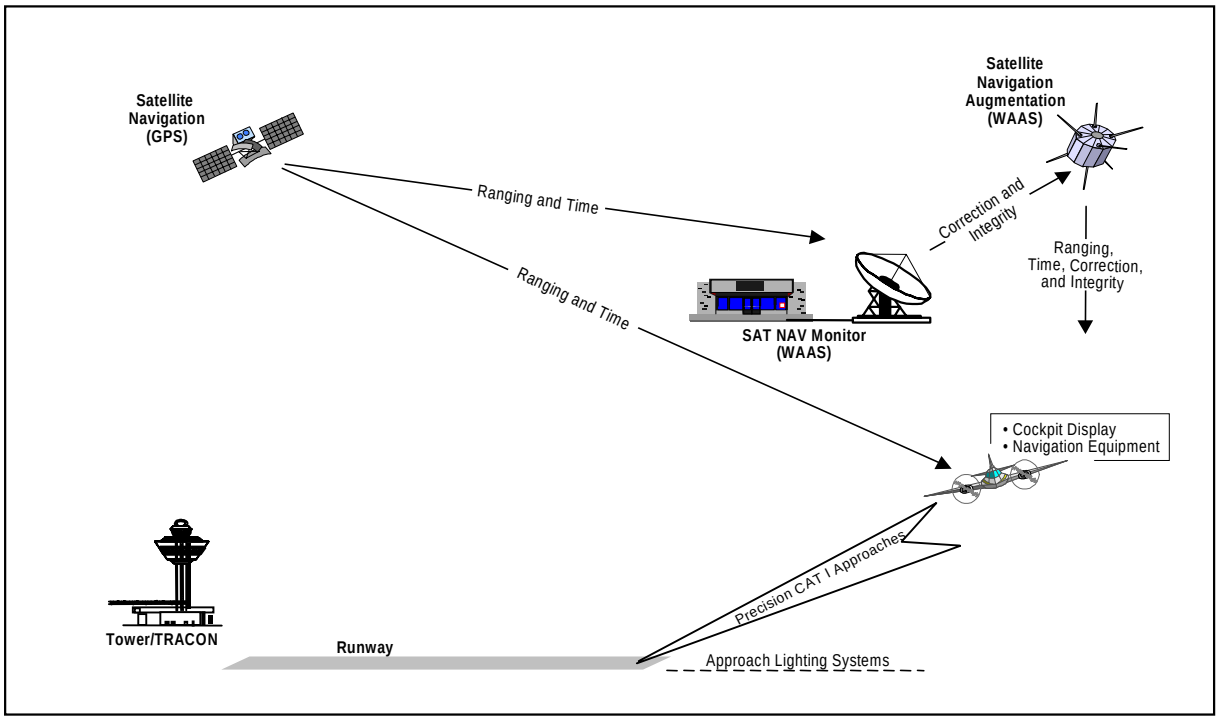

Figure D-1. Increased Navigation/Landing Position Accuracy and Site Availability, Air Traffic Services, Arrival/Departure, Phase 1 (1998–2002)

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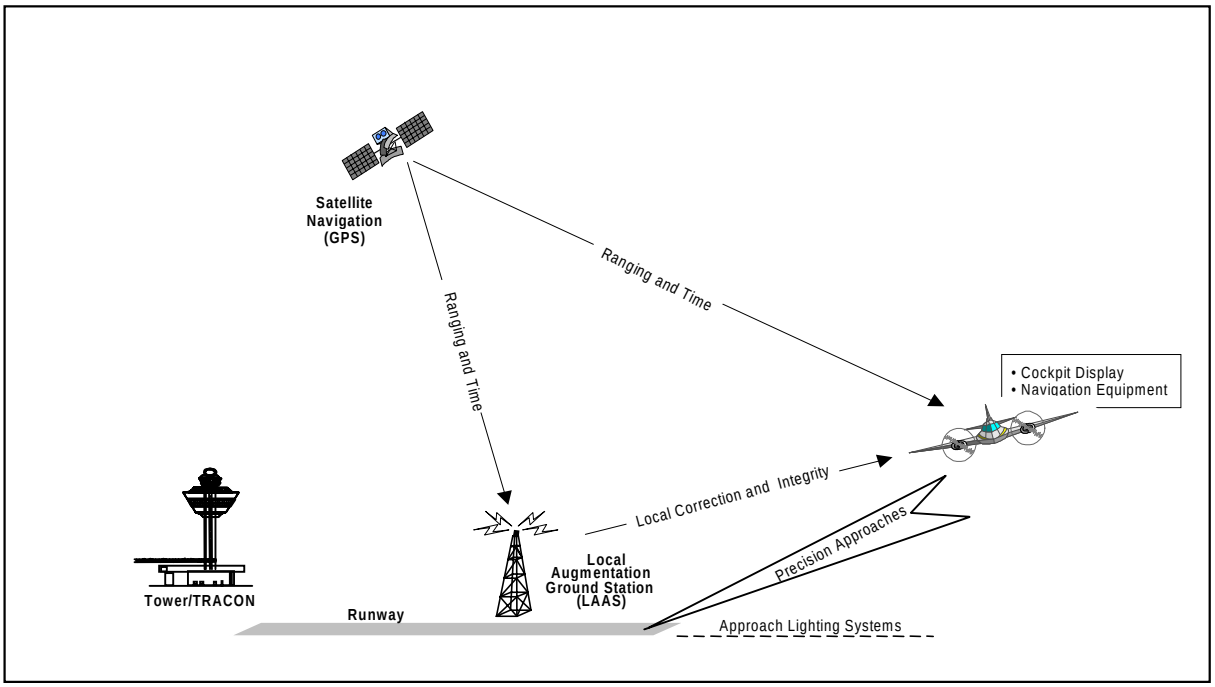

Figure D-2. Increased Navigation/Landing Position Accuracy and Site Availability, Air Traffic Services, Arrival/Departure, Phase 2 (2003–2007)

- Site availability is improved due to the increase in CAT I approaches available at potential alternate landing sites.

Phase 2 (2003–2007)

- Satellite-based navigation will be locally augmented to provide increased precision guidance accuracy, integrity, and availability.
- Local GPS augmentation allows for CAT II/III precision approach capability and for increased availability of CAT I approaches.

Phase 3 (2008–2015)

- No additional change in capability.

1. Increased Navigation/Landing Position Accuracy and Site Availability, Air Traffic Services, Oceanic

Figure D-3 shows Phase 1 of this capability.

Phase 1 (1998–2002)

- Improved position accuracy is obtained by using range and time data from GPS. The location will be displayed for the pilot.
- Inertial guidance systems and satellite-based navigation equipment are available to support area navigation operations aboard properly equipped aircraft. This provides a more precise and reliable means of navigation during long flights over water.

Phase 2 (2003–2007)

- No additional changes in capability.

Phase 3 (2008–2015

- Same functionality as En Route/Cruise.

1. Increased Navigation/Landing Position Accuracy and Site Availability, Air Traffic Services, NAS-Wide

Figure D-4 shows Phase 1 of this capability.

Phase 1 (1998–2002)

- Improved position accuracy is obtained by using range and time data from GPS, and GPS correction and integrity information from WAAS. GPS correction and integrity information from ground systems (WAAS) is relayed through satellites to ensure the signal in space will provide coverage for aircraft at various altitudes. The aircraft's location is displayed to pilots. GPS equipment and GPS augmentation provide vertical reference and enhance aircraft area navigation (RNAV) capability for point-to-point flight routing.

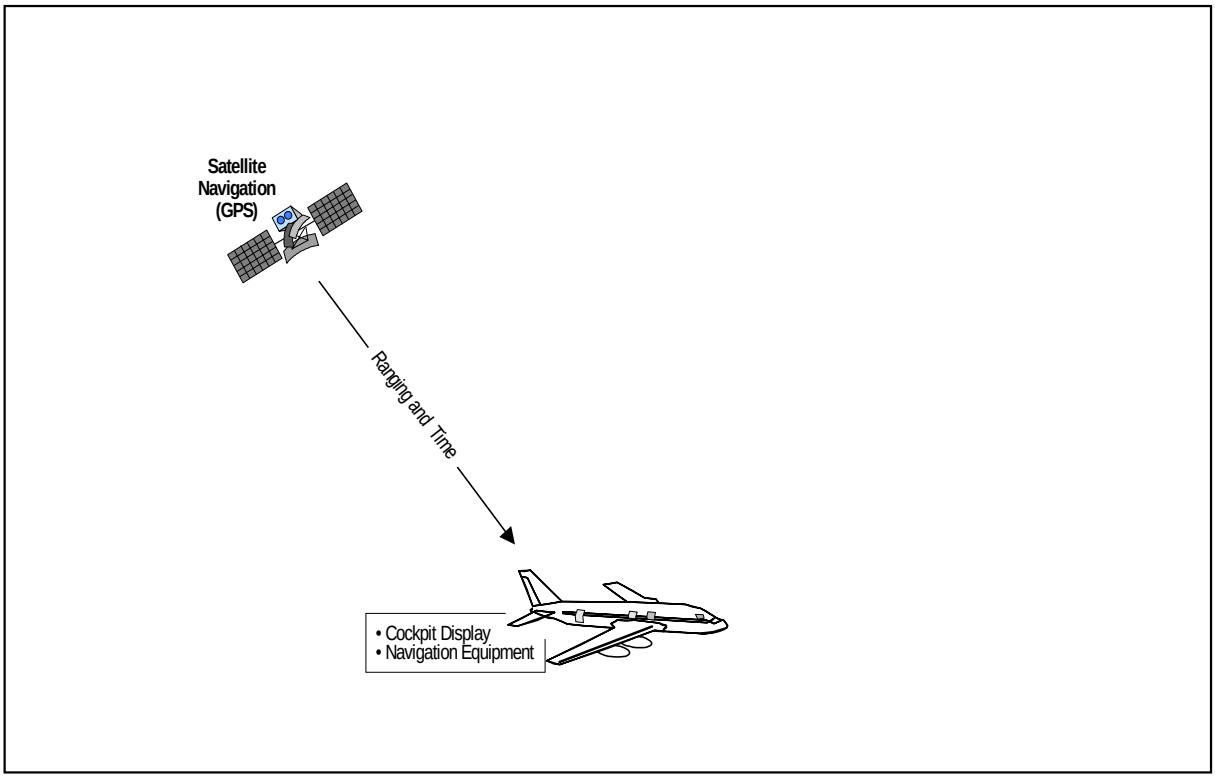

Figure D-3. Increased Navigation/Landing Position Accuracy and Site Availability, Air Traffic Services, Oceanic, Phase 1 (1998–2002)

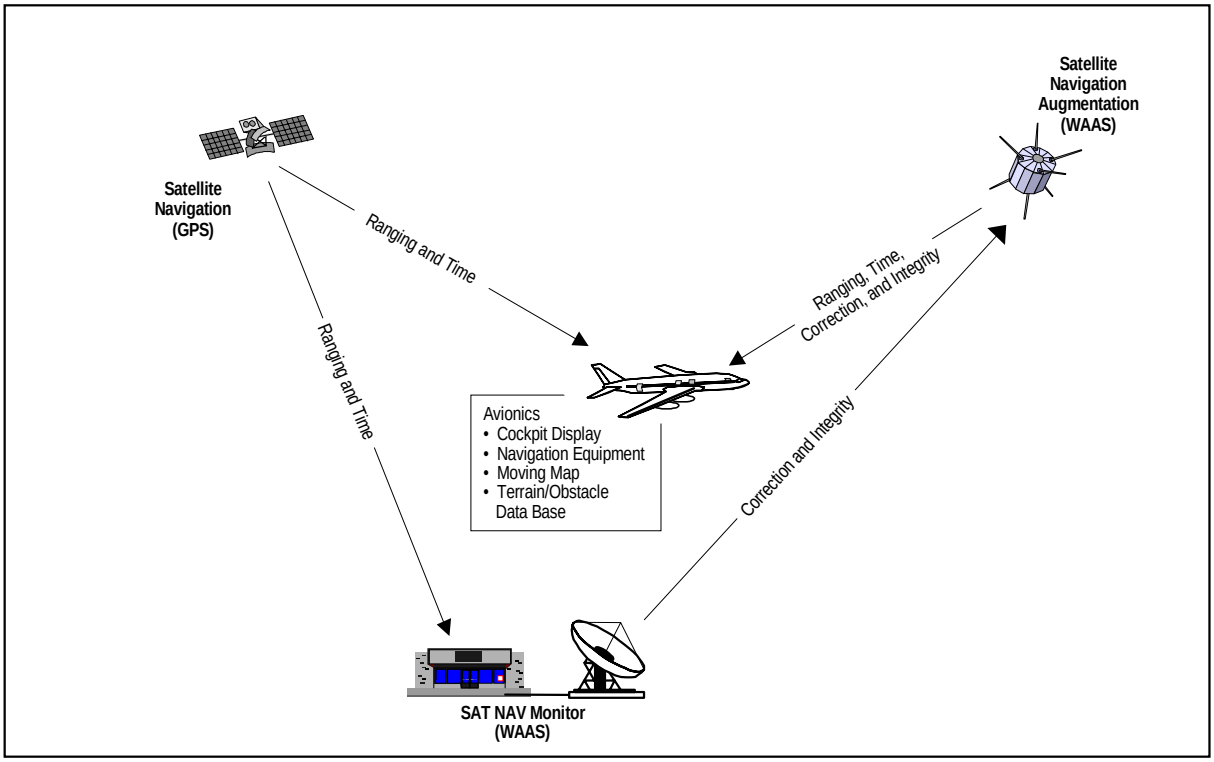

Figure D-4. Increased Navigation/Landing Position Accuracy and Site Availability, Air Traffic Services, NAS-Wide, Phase 1 (1998–2002)

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- Avionics enhancements could include moving terrain map and position display on the cockpit displays.
- An enhanced terrain awareness warning system (TAWS) provides pilots with more ground proximity warning time.

Phase 2 (2003–2007)

- No additional change in capability.

Phase 3 (2008–2015)

- No additional change in capability.

2. Increased Exchange of Common Weather Data, Air Traffic Services, Arrival/Departure

Figures D-5, -6, and -7 show Phases 1, 2, and 3, respectively, of this capability.

Phase 1 (1998–2002)

- In-flight graphical terminal weather information (TWIP) is provided to pilots based on weather radar data (TDWR, ASR-9 WSP) relayed through a service provider. This service is primarily for commercial carriers.
- Local weather radar, sensor information, and National Weather Service (NWS) weather products are integrated for improved distribution.
- The integrated weather products are distributed to other facilities (i.e., terminal radar control facility (TRACON), automated flight service station (AFSS), air route traffic control center (ARTCC), Department of Defense (DOD)) for rapid dissemination to all users who need the information. Ground weather observation data are broadcast directly to the aircraft operating in the local area.
- Weather information, including pilot reports (PIREPs), is transmitted to the cockpit via existing very high and ultra high frequency (VHF/UHF) radios. This will continue to meet the needs of aircraft not equipped to receive digital weather data.

Phase 2 (2003–2007)

- Integrated weather data are displayed on the service provider's workstation.

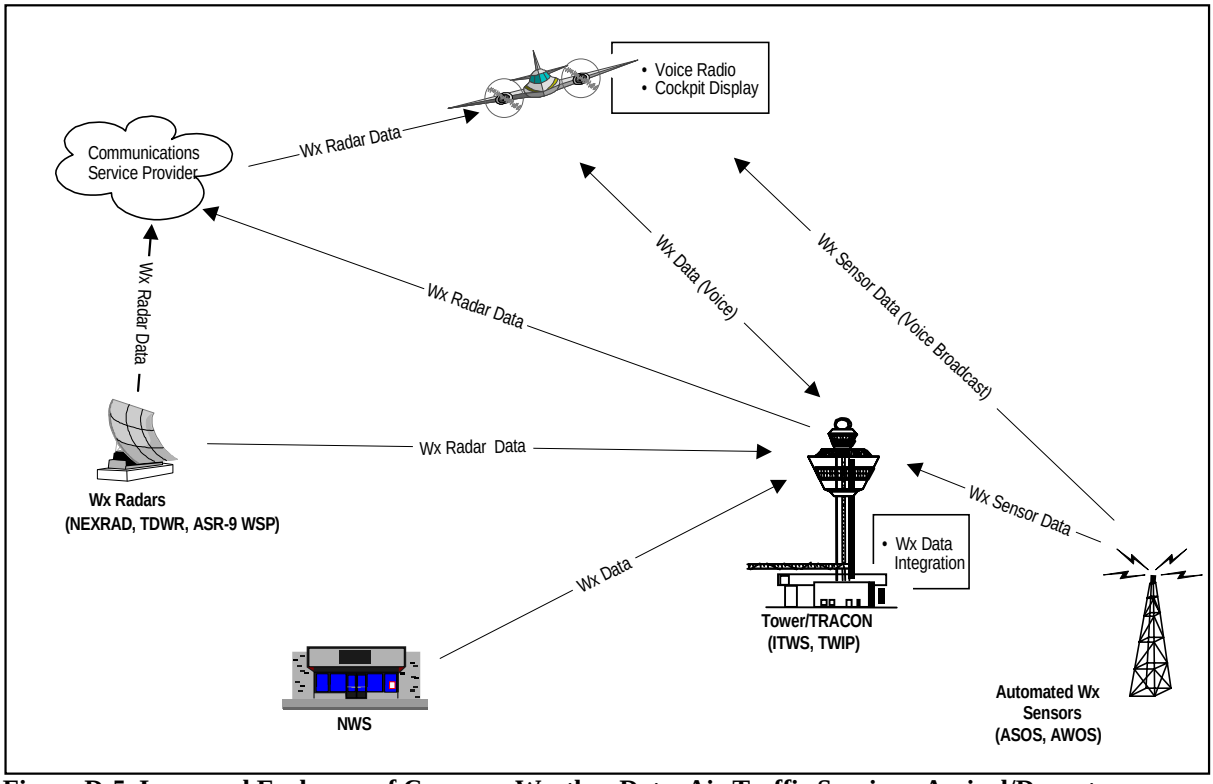

Figure D-5. Increased Exchange of Common Weather Data, Air Traffic Services, Arrival/Departure, Phase 1 (1998–2002)

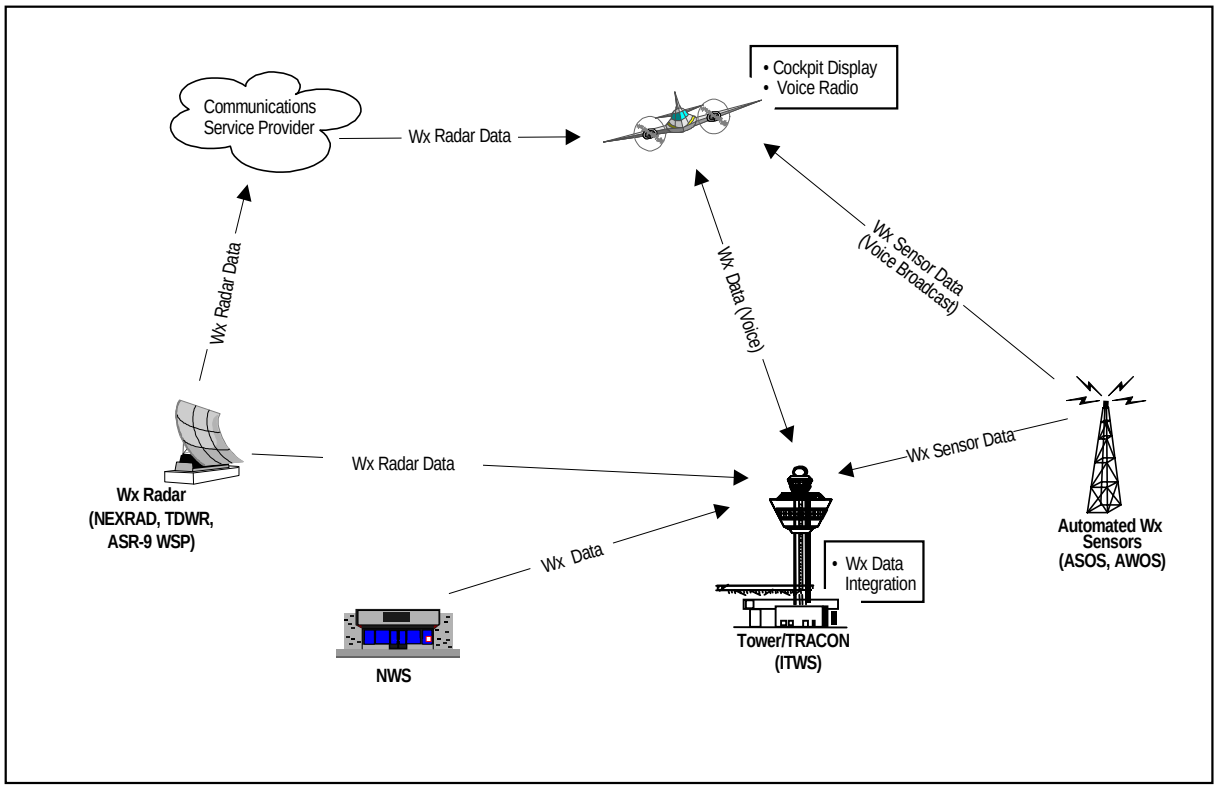

Figure D-6. Increased Exchange of Common Weather Data, Air Traffic Services, Arrival/Departure, Phase 2 (2003–2007)

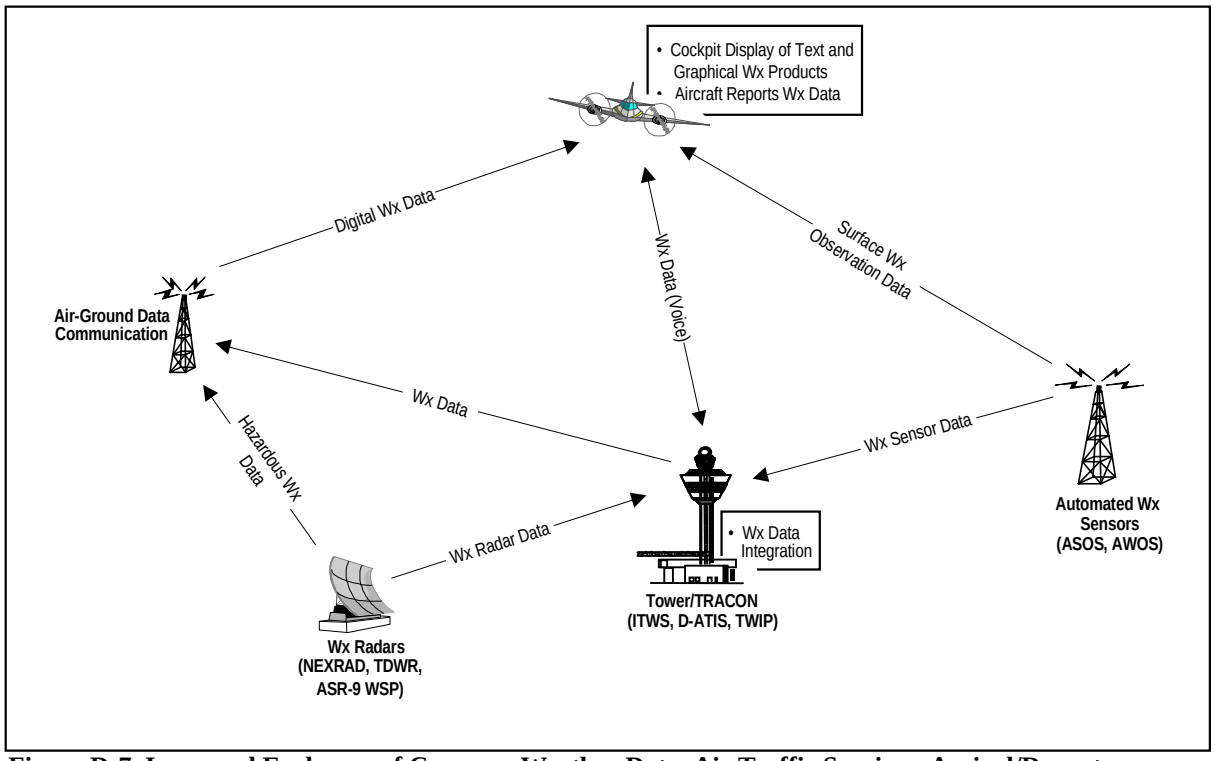

Figure D-7. Increased Exchange of Common Weather Data, Air Traffic Services, Arrival/Departure, Phase 3 (2008–2015)

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- Service provider workload is reduced as the weather and air traffic information is presented on a common display.
- Terminal weather systems will continue to produce new and improved weather products.

Phase 3 (2008–2015)

- Provides real-time windshear alert information to pilots and service providers automatically and simultaneously.

2. Increased Exchange of Common Weather Data, Air Traffic Services, En Route/Cruise

Figure D-8 shows Phase 1 of this capability.

Phase 1 (1998-2002)

- Weather information is available in the cockpit to users at all levels of avionics/communications equipage based on improved availability/access to center (ARTCC) and flight service station (FSS/AFSS) service providers. Data from multiple weather sensing sources are integrated at the ARTCC and displayed on en route service providers' workstations. In the ARTCC, traffic management specialists see terminal weather information, and the ARTCCs distribute integrated weather products to AFSSs and the NWS.
- Terminal weather information is exchanged within the ARTCCs to provide a common weather data picture among terminal and en route service providers.
- Users continue to observe and disseminate weather information. Pilots continue to provide information to the ARTCC or AFSS about in-flight conditions in pilot voice reports (PIREPS).
- Weather information exchange between pilots and service providers continues via existing radios.

Phase 2 (2003–2007)

- No additional change in capability.

Phase 3 (2008–2015)

- No additional change in capability.

2. Increased Exchange of Common Weather Data, Air Traffic Services, NAS-Wide

Figure D-9 shows Phase 1 of this capability.

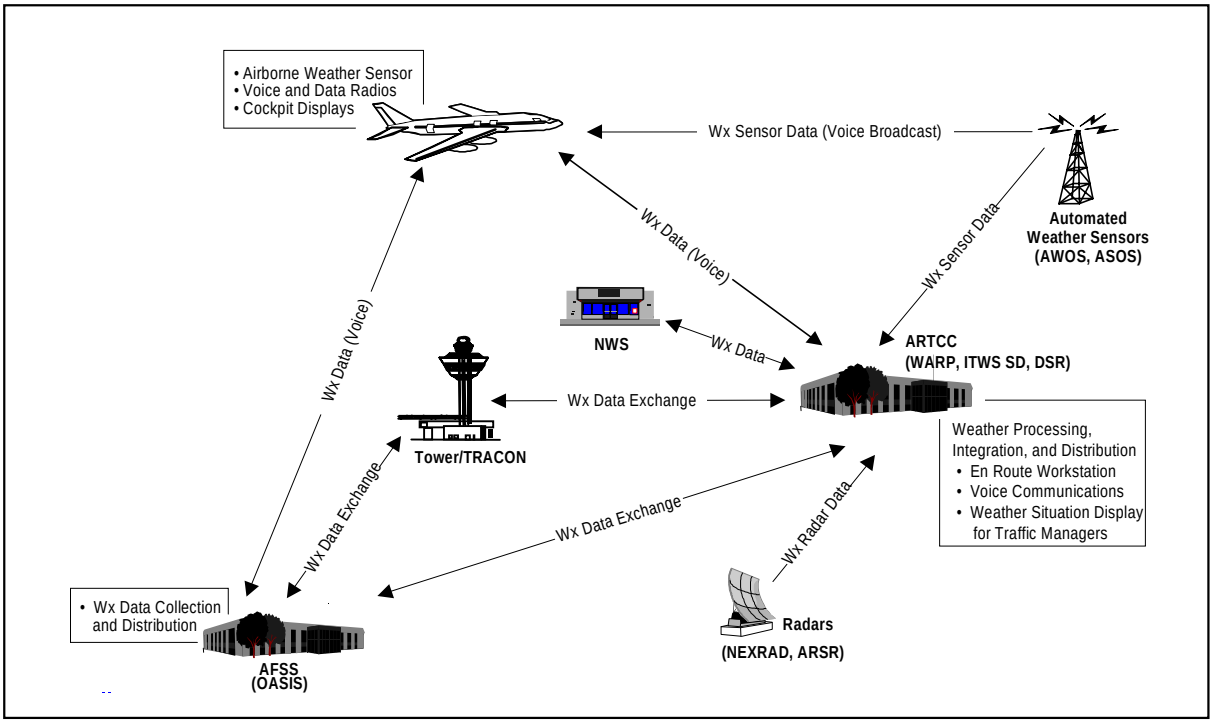

Figure D-8. Increased Exchange of Common Weather Data, Air Traffic Services, En Route/Cruise, Phase 1 (1998–2002)

Phase 1 (1998–2002)

- Some commercial aircraft act as weather sensors, providing real-time wind, temperature, and humidity data for improved weather forecasting and traffic planning.
- A collection of in-flight weather data is transmitted to the NWS from properly equipped aircraft. The NWS processes the information at its modeling centers, constantly updating computer models with new data to provide improved hourly forecasts of aviation-impacting weather.
- Private vendors provide weather data as part of the flight information service (FIS). Some air crews have access to both textual weather updates and graphical weather displays.

Phase 2 (2003–2007)

- No additional change in capability.

Phase 3 (2008–2015)

- No additional change in capability.

3. Improved Aircraft Positional Accuracy Reporting to Service Providers, Air Traffic Services, Tower/Airport Surface

Figures D-10, -11, and -12 show Phases 1, 2, and 3, respectively, of this capability.

Phase 1 (1998–2002)

- At the busiest airports, the airport surface detection equipment (ASDE) provides controllers with primary radar targets to display the position of aircraft and vehicles operating on airport taxiways and runways. ASDE with the airport movement area safety system (AMASS) provides target information and alerts controllers to potential collision situations in the airport movement area.
- Safety is increased by providing conflict detection alerts and improving controllers' situational awareness, particularly in low-visibility conditions.

Phase 2 (2003-2007)

- At airports that do not have ASDE/AMASS, but are large enough to qualify for the runway incursion reduction program, primary radar data will be provided to controllers to help avoid runway incursions.
- Airport markings, signage, and lighting will be improved. Also, improvements will be made in the training for pilots about runway markings, signage, and lights.

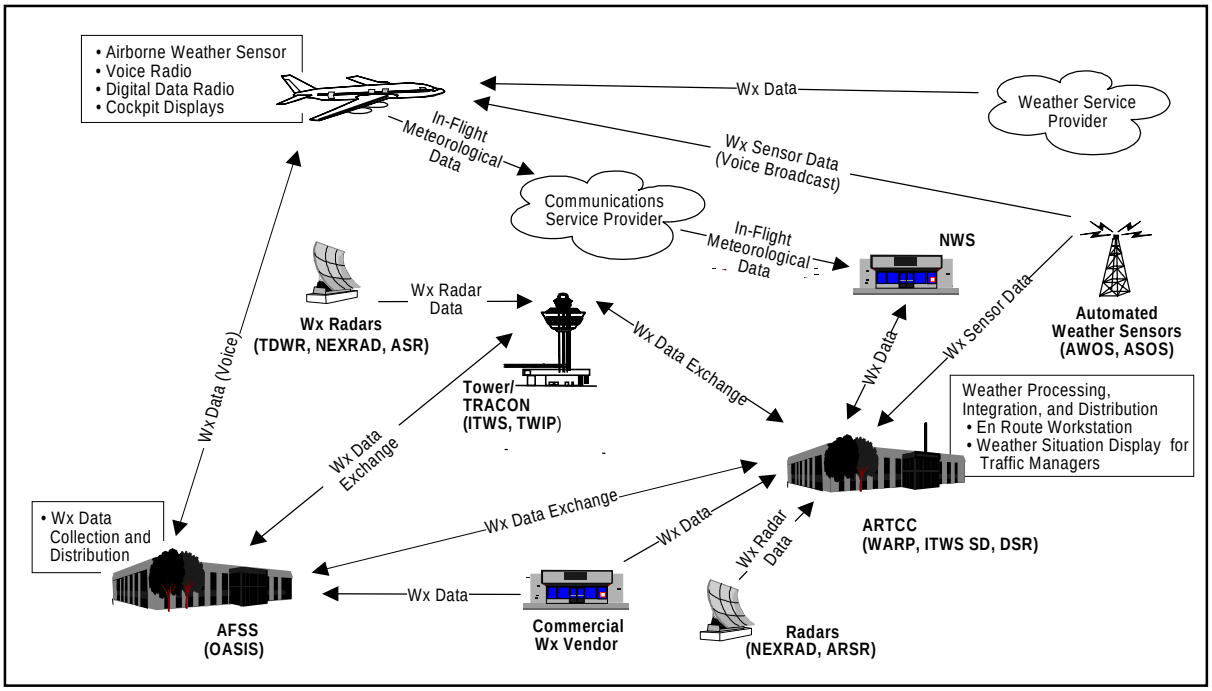

Figure D-9. Increased Exchange of Common Weather Data, Air Traffic Services, NAS-Wide, Phase 1 (1998–2002)

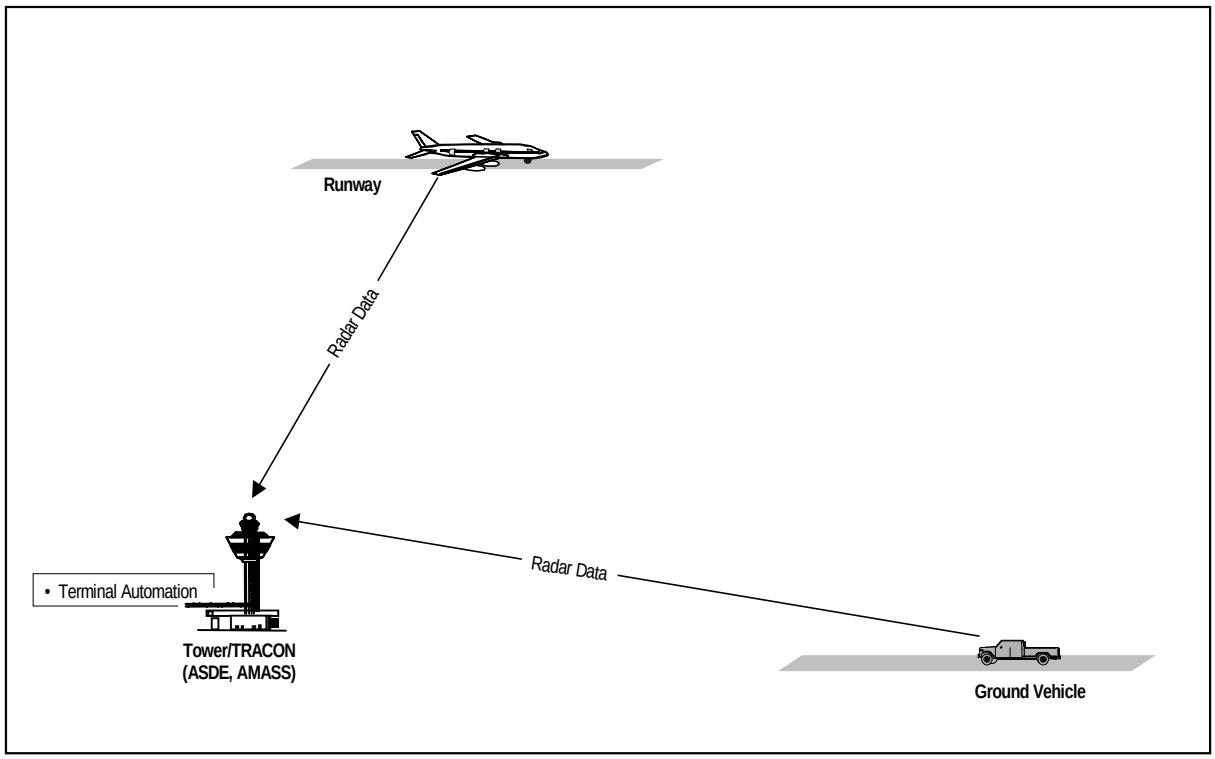

Figure D-10. Improved Aircraft Positional Accuracy Reporting to Service Providers, Air Traffic Services, Tower/Airport Surface, Phase 1 (1998–2002)

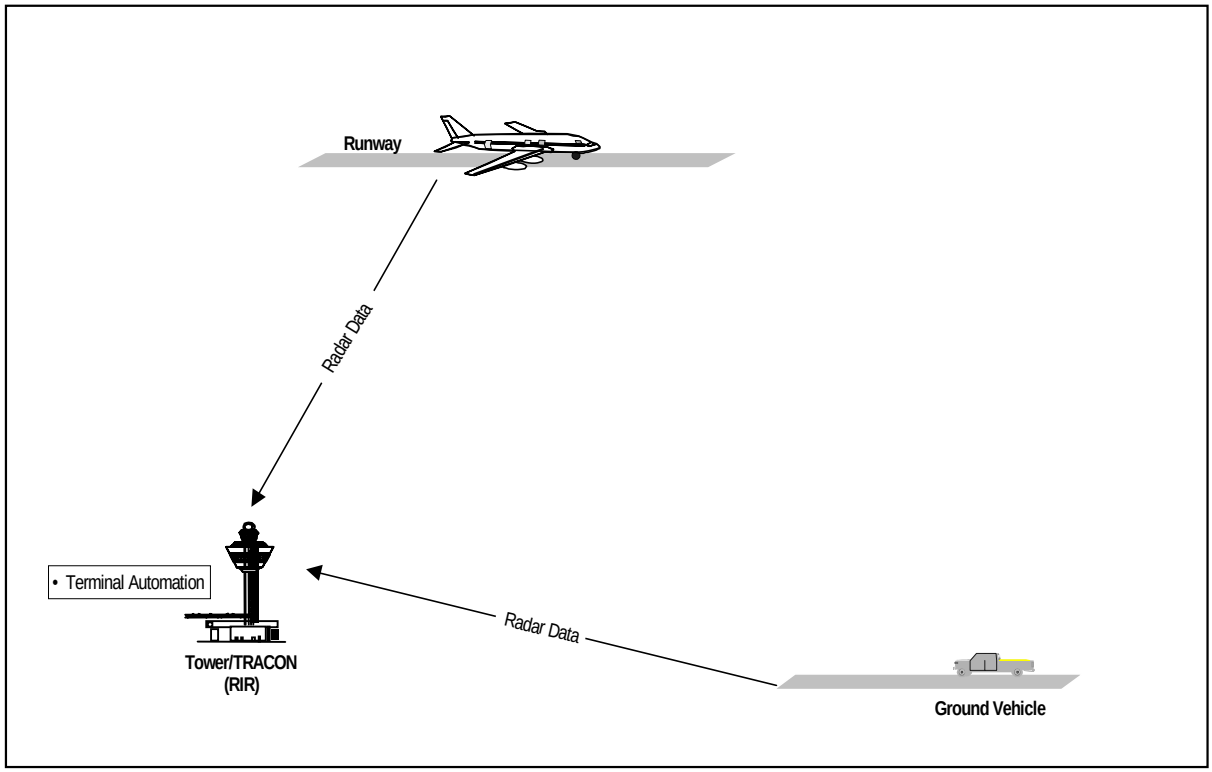

Figure D-11. Improved Aircraft Positional Accuracy Reporting to Service Providers, Air Traffic Services, Tower/Airport Surface, Phase 2 (2003–2007)

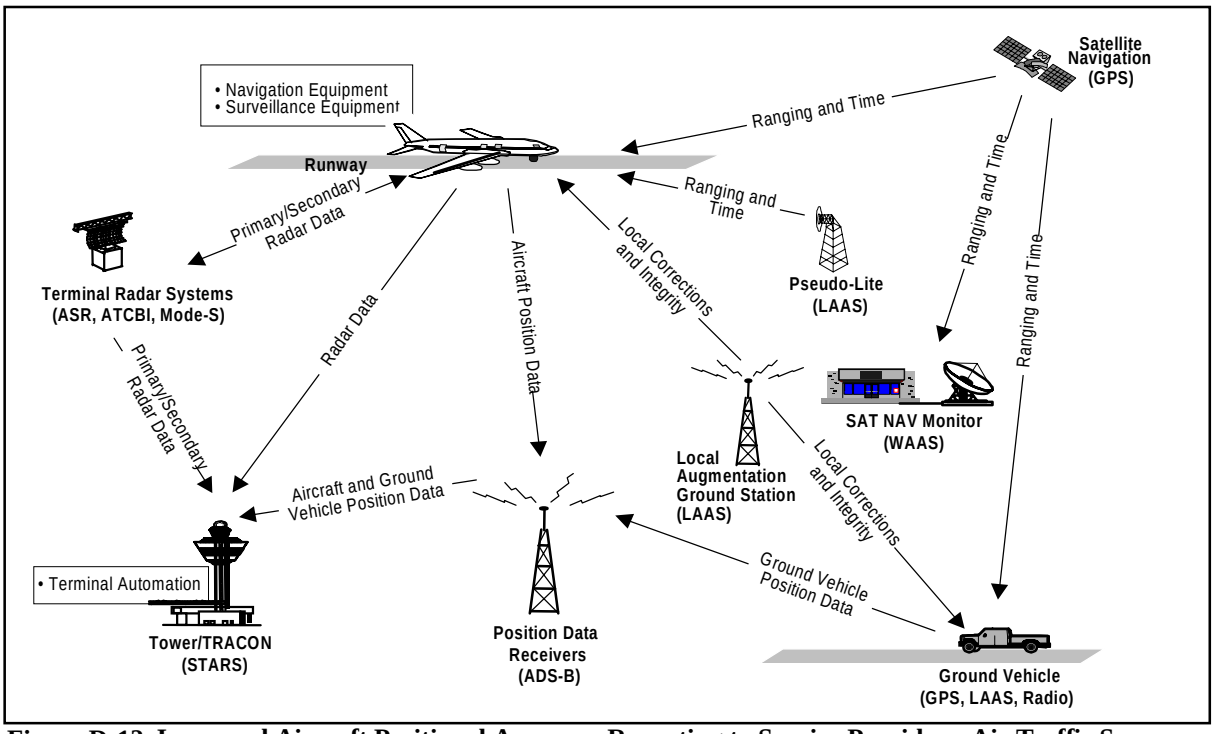

Figure D-12. Improved Aircraft Positional Accuracy Reporting to Service Providers, Air Traffic Services, Tower/Airport Surface, Phase 3 (2008–2015)

- Airport surveillance monitoring is more effective as surface surveillance accuracy is enhanced by the introduction of augmented GPS reports from aircraft and vehicular traffic.

Phase 3 (2008–2015)

- Integrated Tower Area Surveillance provides controllers better position information about the air traffic based on GPS. It also provides controllers integrated information about the arriving aircraft and airport surface aircraft.

3. Improved Aircraft Positional Accuracy Reporting to Service Providers, Air Traffic Services, Arrival/Departure

Figures D-13 and -14 show Phases 1 and 2, respectively, of this capability.

Phase 1 (1998–2002)

- Aircraft position accuracy reporting to service providers is improved.

Phase 2 (2003–2007)

- Terminal secondary surveillance radar (SSR) will be upgraded with the All Purpose Structured EUROCONTROL Radar Information Exchange (ASTERIX) surveillance and weather message transfer protocol. This upgrade will allow the aircraft navigational system and waypoint data (i.e., ADS-B data) received in ground-initiated Comm B (GICB) replies to be processed. Selective interrogation (SI) capability allows the air traffic control (ATC) automation to use the unique Mode-S transponder identification code permanently assigned to an aircraft. SI also eliminates false data from the controller's display.
- Integrated terminal surveillance with ADS-B provides controllers better position information about air traffic based on GPS.

Phase 3 (2008–2015)

- No additional change in capability.

3. Improved Aircraft Positional Accuracy Reporting to Service Providers, Air Traffic Services, En Route/Cruise

Figure D-15 shows Phase 2 of this capability.

Phase 1 (1998–2002)

- No change in capability.

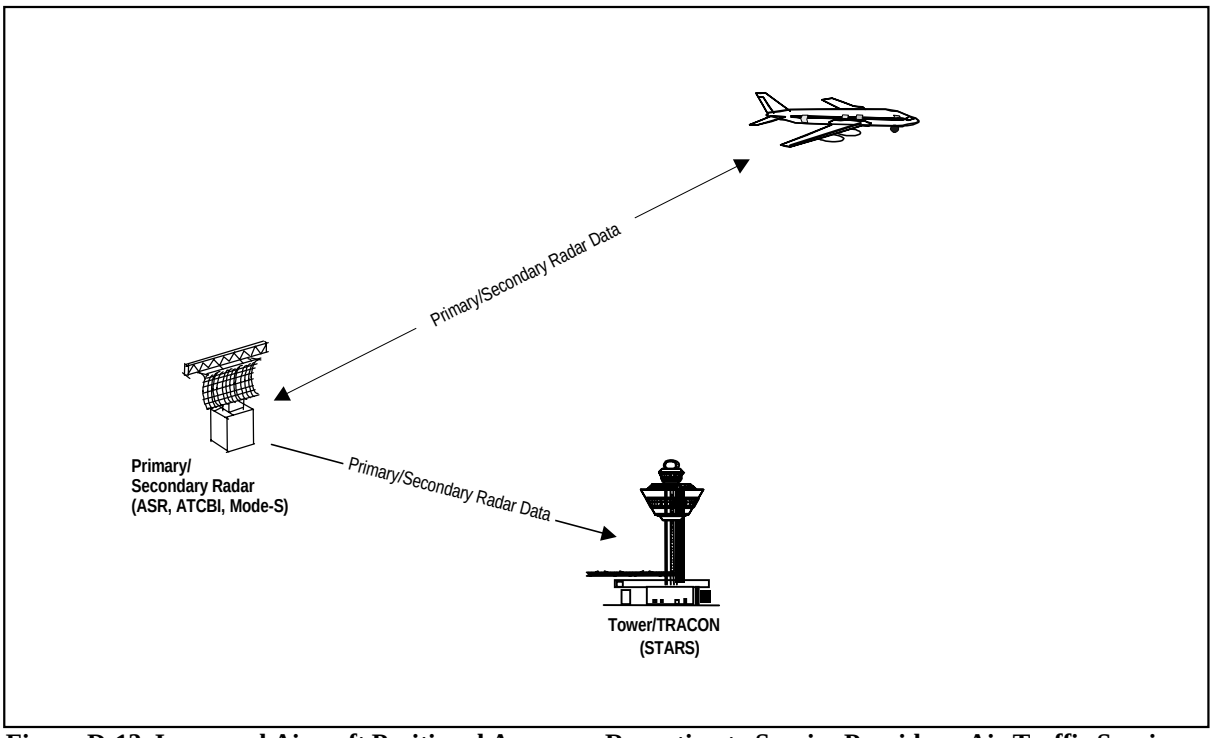

Figure D-13. Improved Aircraft Positional Accuracy Reporting to Service Providers, Air Traffic Services, Arrival/Departure, Phase 1 (1998–2002)

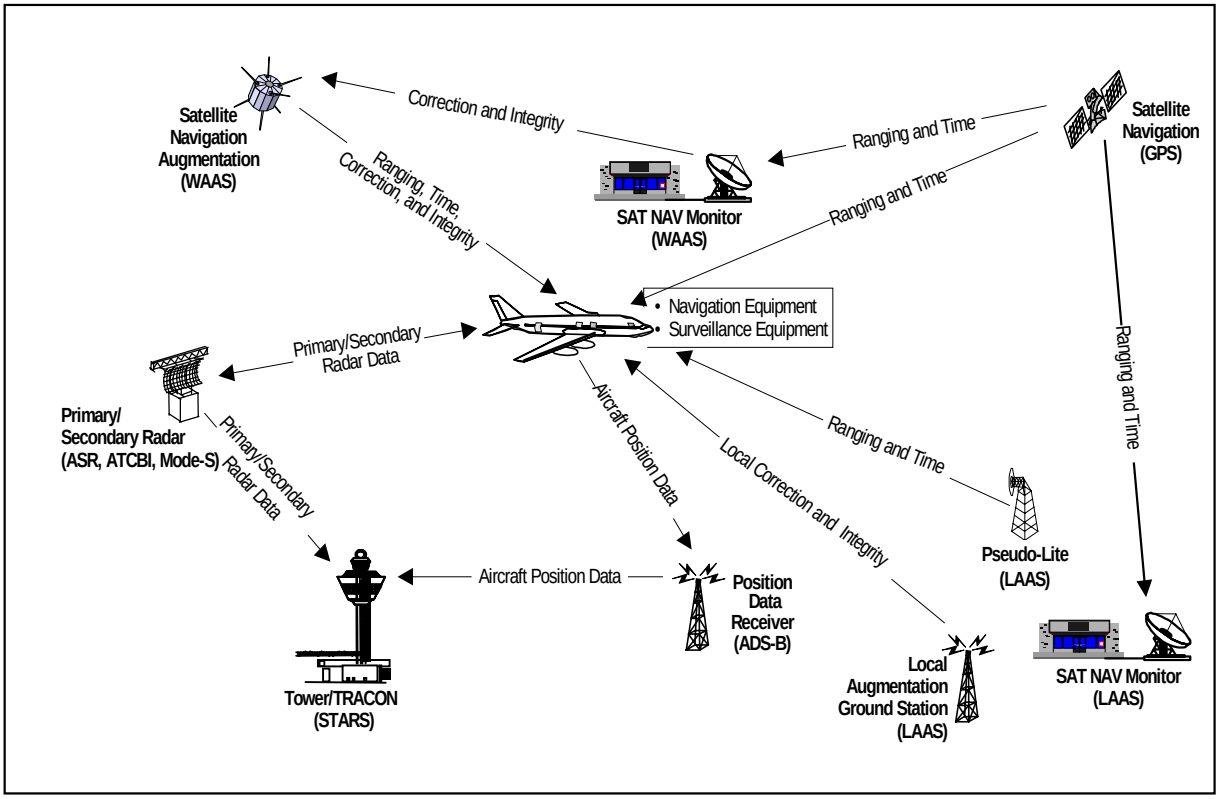

Figure D-14. Improved Aircraft Positional Accuracy Reporting to Service Providers, Air Traffic Services, Arrival/Departure, Phase 2 (2003–2007)

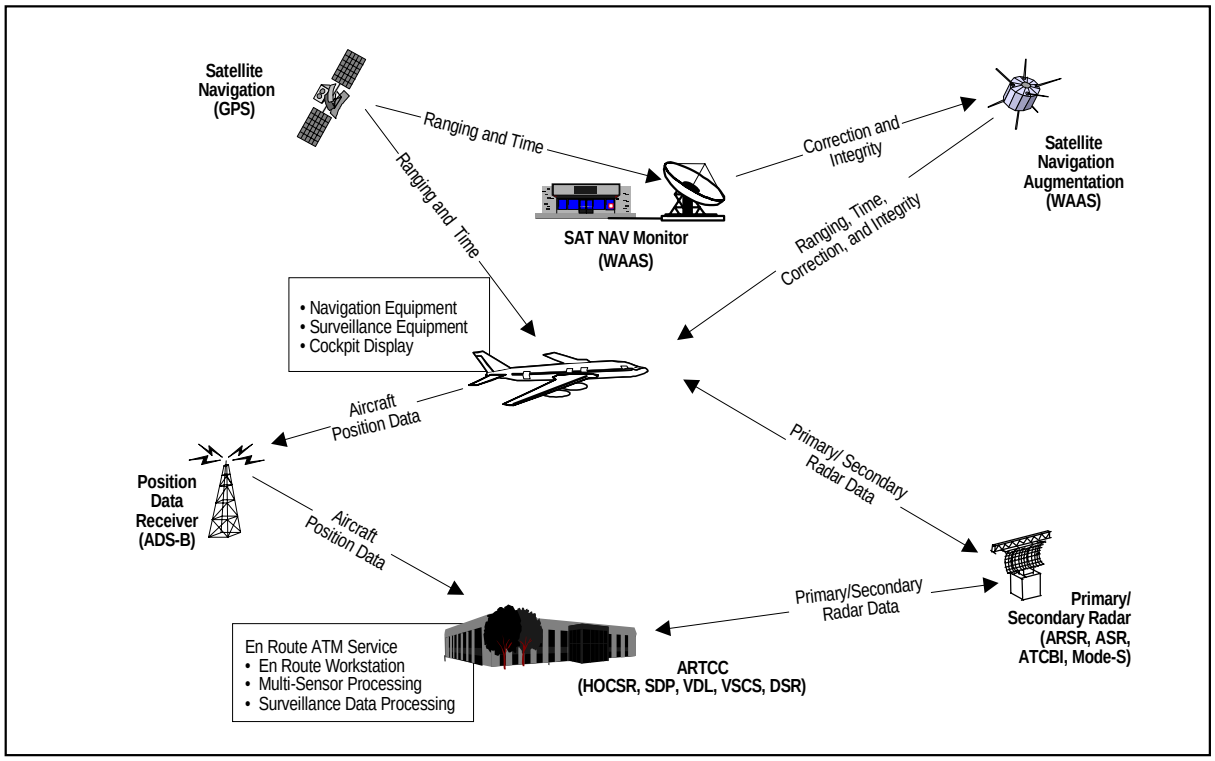

Figure D-15. Improved Aircraft Positional Accuracy Reporting to Service Providers, Air Traffic Services, En Route/Cruise, Phase 2 (2003–2007)

Phase 2 (2003–2007)

- Improved en route surveillance enhances aircraft position accuracy and intent information reporting to service providers. En route surveillance radar will be upgraded with the ASTERIX surveillance and weather message transfer protocol with SI capability. Integrating en route surveillance radar with automatic dependent surveillance broadcast (ADS-B) data provides controllers with better air traffic position information.

- More accurate flight monitoring is provided by widespread use of satellite navigation, improved radar, and the introduction of ADS-B ground processing.

- The position data processing includes combining targets from multiple types of sensors. Data sources include primary and secondary radar systems and ADS-B data.

Phase 3 (2008–2015)

- No additional change in capability.

4. Increased Self-Separation by Properly Equipped Aircraft, Air Traffic Services, NAS-Wide

Figure D-16 shows Phase 1 of this capability.

Phase 1 (1998–2002)

- More accurate position data allow more opportunities for self-separation by increasing flight crew's situational awareness. The satellite-based navigation system determines position from satellite signals and broadcasts the position information. Cockpit display of traffic information (CDTI) from ADS-B permits self-separation maneuvers, such as in-trail climbs. ADS-B provides pilots a cockpit display of traffic information of other ADS-B-equipped aircraft.

- The Mode-S transponder uses beacon-interrogation of nearby aircraft to determine their range, bearing, and altitude. The Traffic Alert And Collision Avoidance System (TCAS) then predicts possible conflicts and displays them to the pilot. Traffic conflict alert technologies currently aboard aircraft provide traffic alerts and resolution advisories to

flight crews. The resolution function provides advisories to climb or descend to avoid the traffic.

- In domestic airspace, pilots may use ADS-B air-air surveillance for situational awareness and limited shared responsibility for separation.
- In oceanic airspace, ADS-B may be approved as a means for pilots to conduct in-trail climbs, descents, and passing maneuvers.
- Aircraft separation is still performed on the ground. To resolve detected conflicts, pilots coordinate anticipated clearance deviations with ATC service providers before taking action.
- Traffic information service via Mode-S provides air traffic surveillance information to properly equipped in-flight aircraft using Mode-S.
- Air-air ADS-B and TCAS traffic information displays aid the pilot during in-trail climbs. Figure D-16 shows an example of self-separation. The aircraft on the left intends to climb past the other aircraft.

Phase 2 (2003–2007)

- No additional change in capability.

Phase 3 (2008–2015)

- No additional change in capability.

5. Increased Surveillance Area Coverage, Air Traffic Services, En Route/Cruise

Figure D-17 shows Phase 2 of this capability.

Phase 1 (1998–2002)

- No change in capability.

Phase 2 (2003–2007)

- Controllers receive satellite-based position reports. Dependent surveillance ground stations extend the range of surveillance coverage.
- Enhanced en route radar coverage provides en route service providers with data from existing terminal secondary radars used to supplement the en route surveillance coverage.

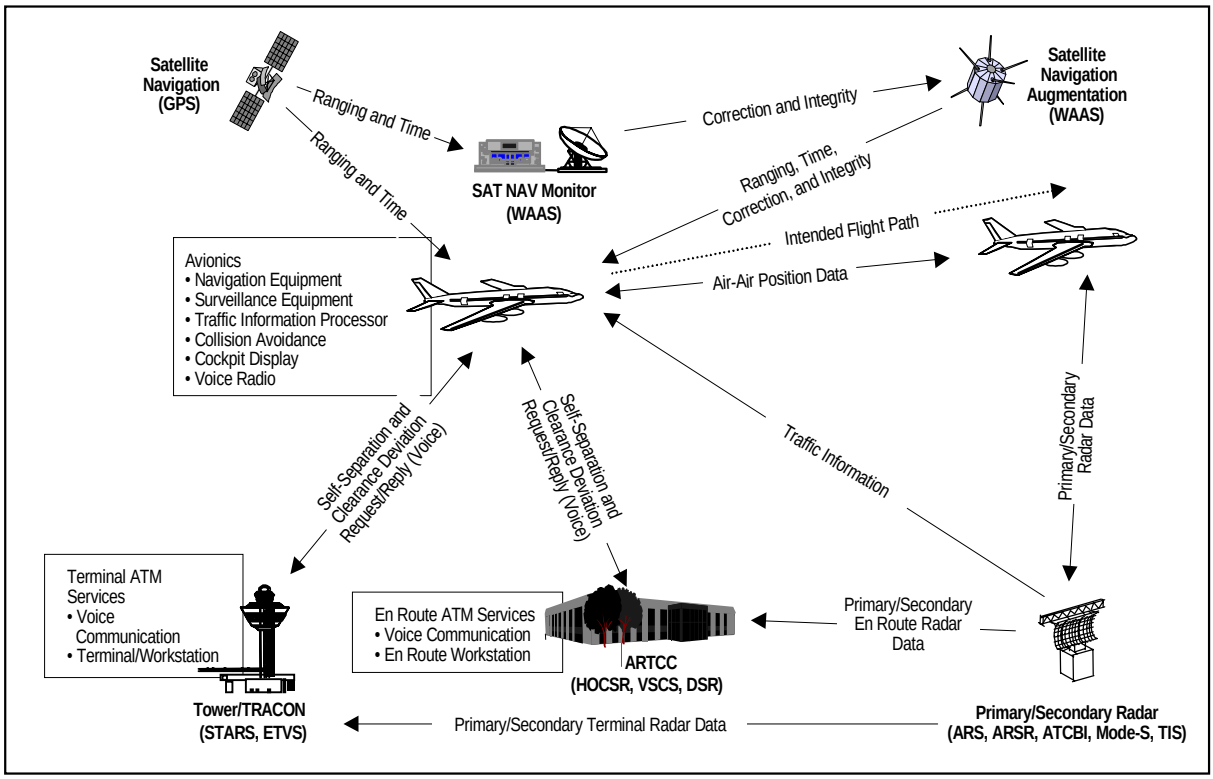

Figure D-16. Increased Self-Separation by Properly Equipped Aircraft, Air Traffic Services, NAS-Wide, Phase 1 (1998–2002)

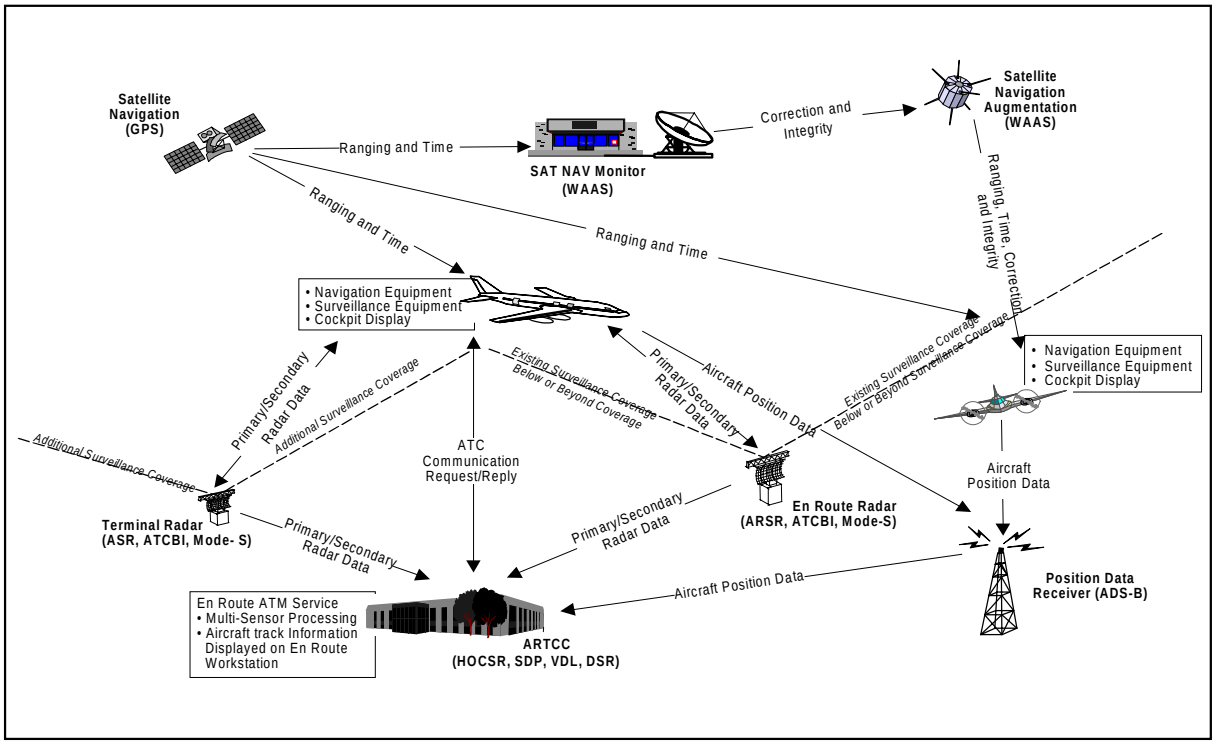

Figure D-17. Increased Surveillance Area Coverage, Air Traffic Services, En Route/Cruise, Phase 2 (2003–2007)

- ADS-B gap-filler provides en route service providers with expanded ability to offer separation services in remote areas not currently covered by radar by providing service providers the ability to receive aircraft position broadcasts.
- The en route automation system will be enhanced to fuse multisensor track data display into a single integrated target on the en route service provider's workstation.

Phase 3 (2008–2015)

No additional change in capability.

5. Increased Surveillance Area Coverage, Air Traffic Services, Oceanic

Figure D-18 shows Phase 2 of this capability.

Phase 1 (1998-2002)

- No change in capability.

Phase 2 (2003-2007)

- Oceanic surveillance via ADS-A (addressable) provides oceanic service providers more timely and more accurate position information about oceanic aircraft.
- ADS will provide surveillance capability in oceanic airspace. ADS-A position reports received from aircraft in oceanic airspace are used to monitor aircraft trajectory from the ground. ADS-A provides position reports generated from the Future Air Navigation System (FANS)-1A- or aeronautical telecommunications network (ATN)-equipped aircraft via satellite communications (SATCOM), high frequency data link (HFDL), or other subnetworks. This gives controllers more timely and accurate position information about oceanic aircraft.
- Coordination between pilots and oceanic controllers is provided by a commercial communications service provider. For aircraft beyond the range of land-based VHF radio communications, the information transfer is by satellite or HF radio.
- ADS increases safety by enhancing situational awareness. It increases capacity by enabling reduced separation of traffic in oceanic airspace by providing controllers more accurate position and intent information about specific aircraft. Flexibility is improved by

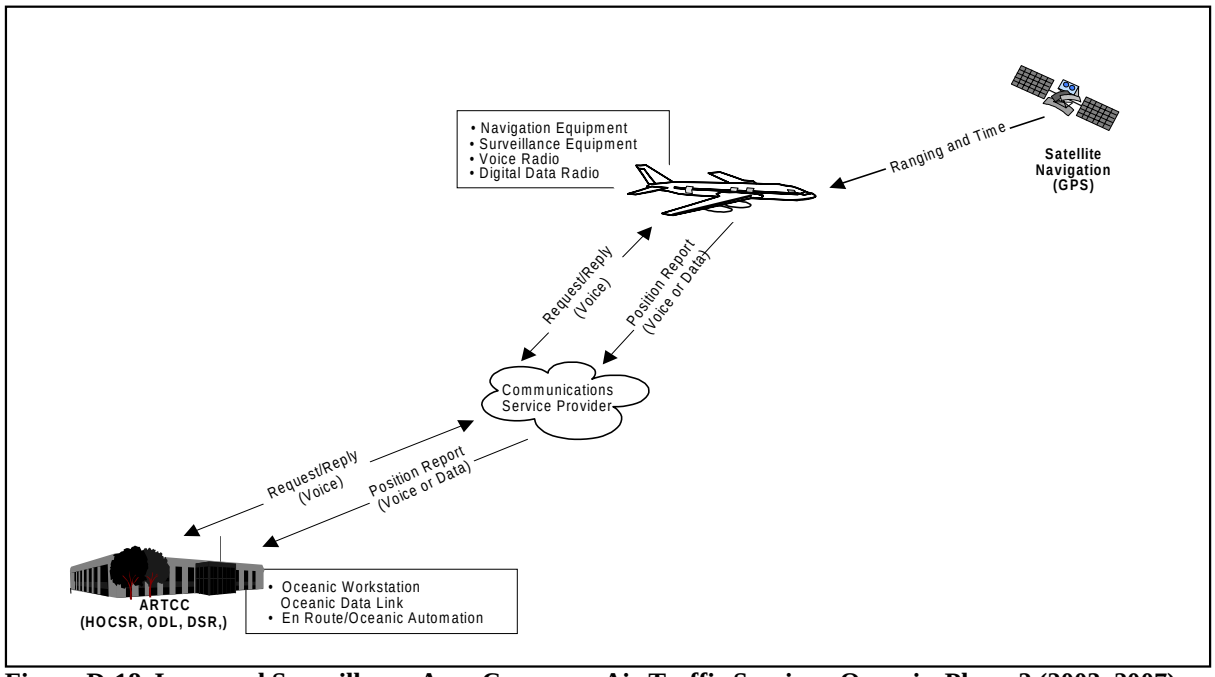

Figure D-18. Increased Surveillance Area Coverage, Air Traffic Services, Oceanic, Phase 2 (2003–2007)

better equipping the oceanic service provider to accommodate flight plan changes in-flight, such as requests for faster aircraft to pass slower aircraft.

Phase 3 (2008-2015)

- No additional change in capability.

6. Increased Digital Voice and Data Communication Among Service Providers and Pilots, Air Traffic Services, Tower/Airport Surface

Figures D-19 and -20 show Phases 1 and 2, respectively, of this capability.

Phase 1 (1998–2002)

- Limited terminal information (e.g., predeparture clearance (PDC), automated terminal information system (ATIS)) is delivered via data link to aircraft on the surface through a data communications service provider.
- VHF/UHF voice continues to be the primary means of communication.

Phase 2 (2003–2007)

- Predeparture clearance and ATIS terminal information is provided to the pilot via service provider data link at an expanded number of airports. This allows a specific set of data to be transmitted from the tower service provider to aircraft.

Phase 3 (2008–2015)

- No additional change in capability.

6. Increased Digital Voice and Data Communications Among Service Providers and Pilots, Air Traffic Services, En Route/Cruise

Figures D-21, -22, and -23 show Phases 1, 2, and 3, respectively, of this capability.

Phase 1 (1998–2002)

- Initial applications of controller-pilot data link (CPDLC Build 1) are limited to less complex and less safety-critical data link functions, such as initial contact, transfer of communications, predefined controller messages, and altimeter setting messages. Communications services are provided by a communications service provider.
- CPDLC Build 1A provides for national deployment of a limited set (18) of critical data link messages.
- Weather data collected in-flight by aircraft equipped with the Meteorological Data Collection and Reporting System (MDCRS) are downlinked via a communications service provider and used for weather forecasting.

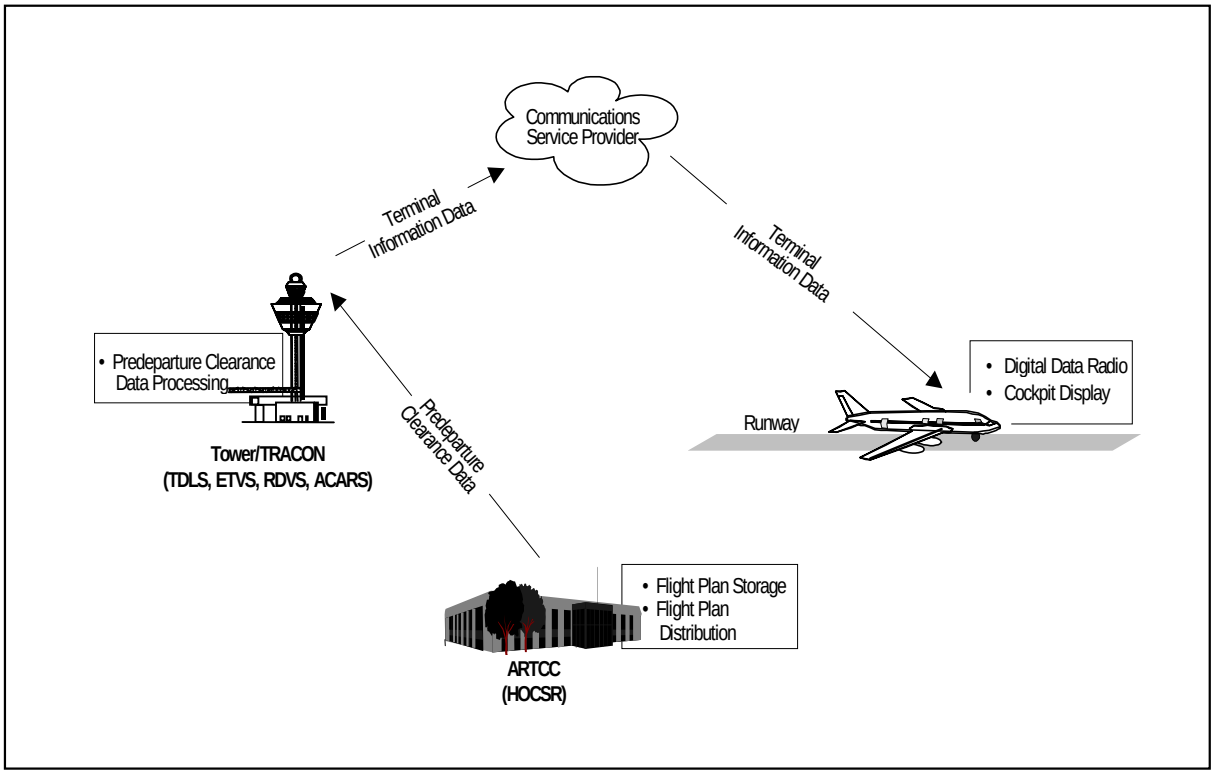

Figure D-19. Increased Digital Voice and Data Communications Among Service Providers and Pilots, Air Traffic Services, Tower/Airport Surface, Phase 1 (1998–2002)

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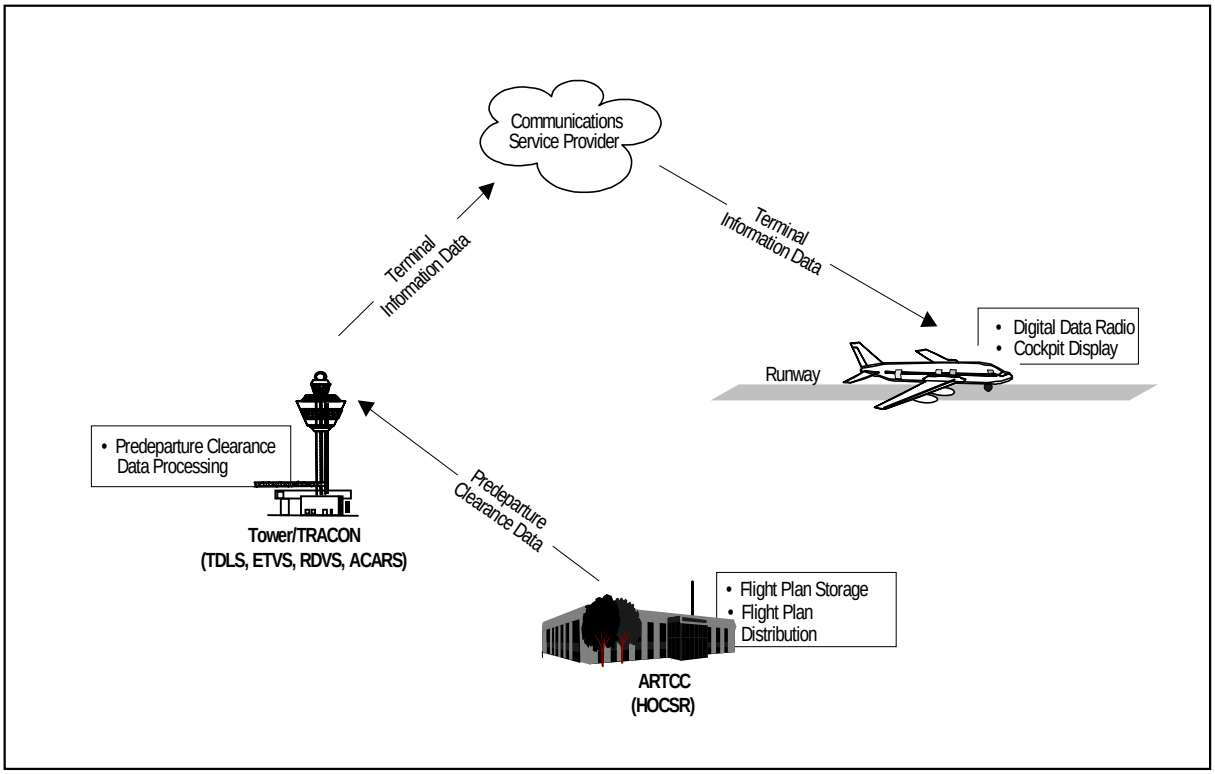

Figure D-20. Increased Digital Voice and Data Communications Among Service Providers and Pilots, Air Traffic Services, Tower/Airport Surface, Phase 2 (2003–2007)

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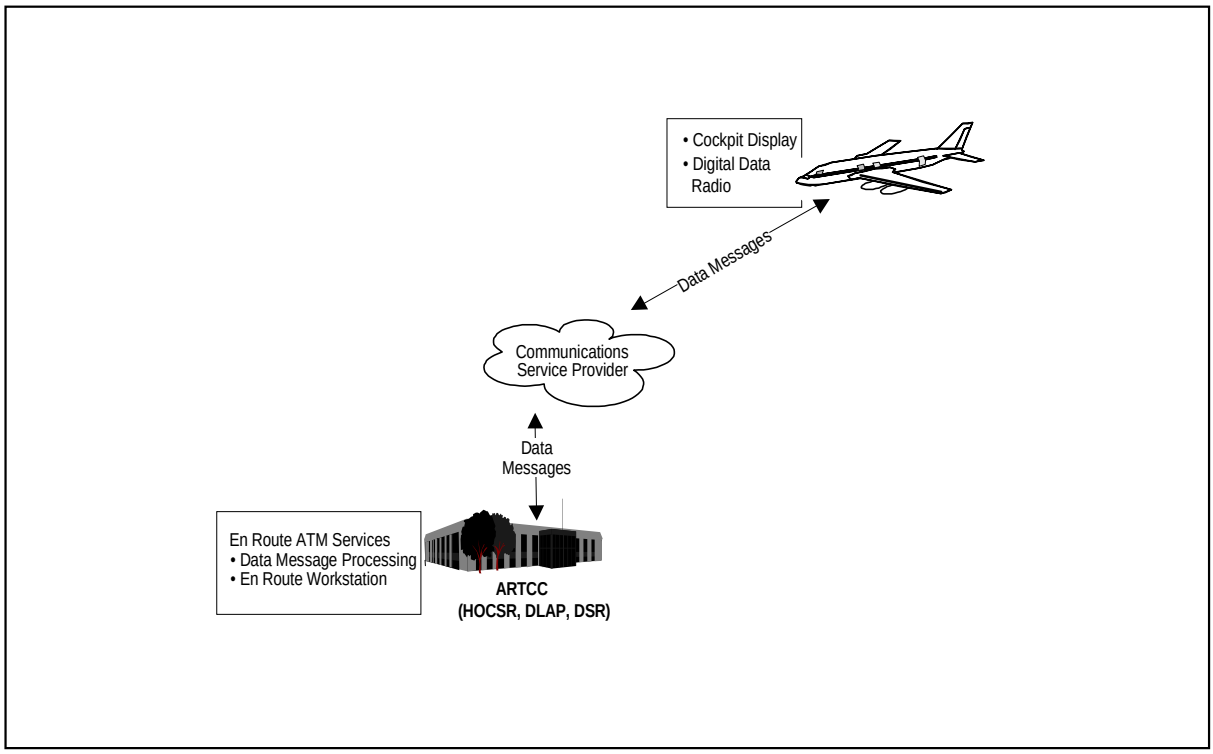

Figure D-21. Increased Digital Voice and Data Communications Among Service Providers and Pilots, Air Traffic Services, En Route/Cruise, Phase 1 (1998–2002)

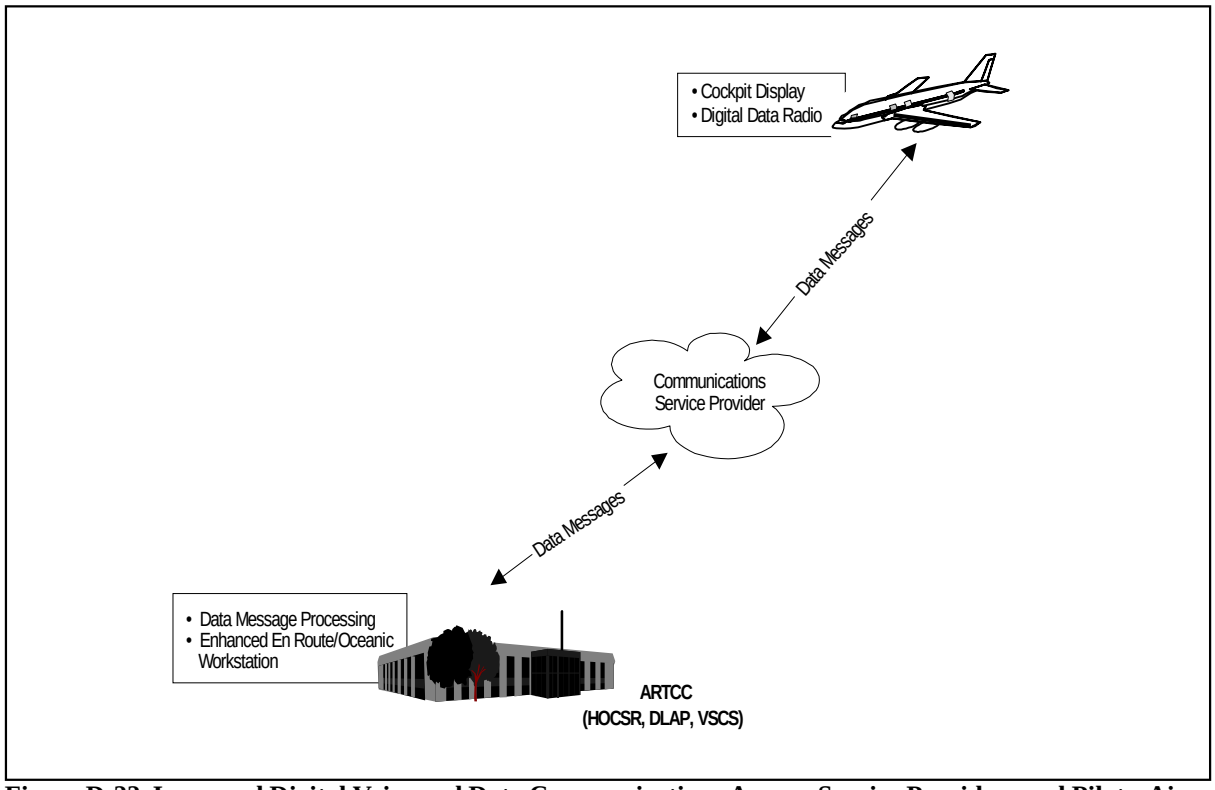

Figure D-22. Increased Digital Voice and Data Communications Among Service Providers and Pilots, Air Traffic Services, En Route/Cruise, Phase 2 (2003–2007)

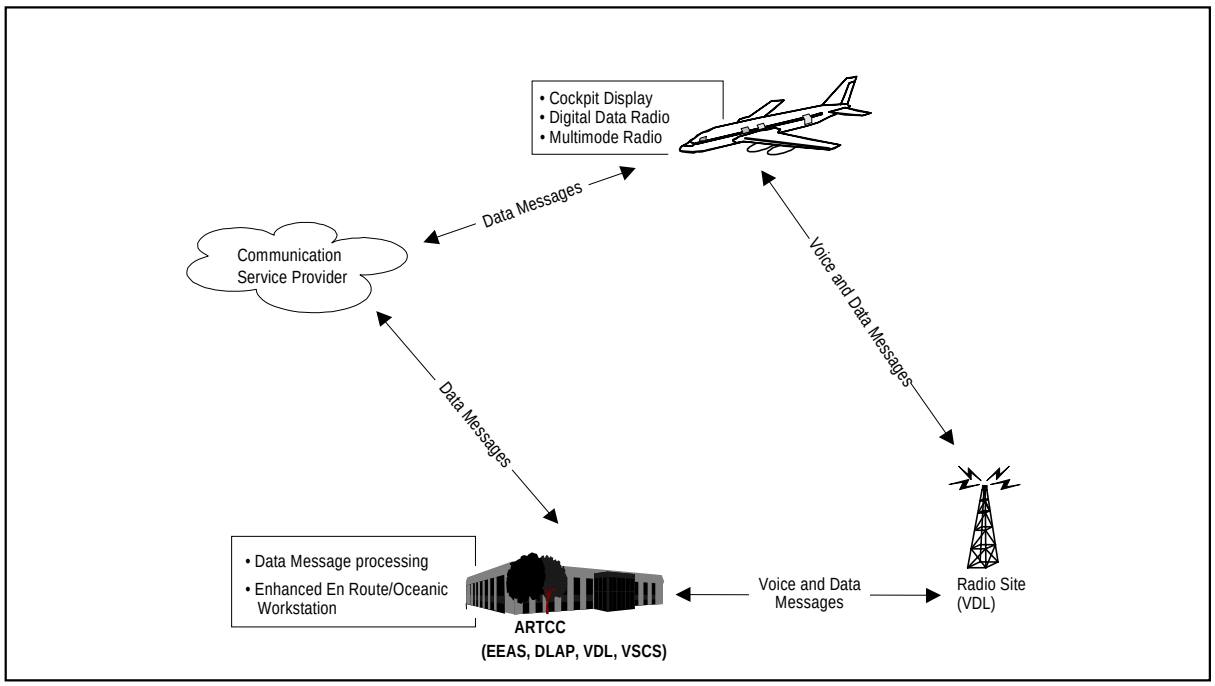

Figure D-23. Increased Digital Voice and Data Communications Among Service Providers and Pilots, Air Traffic Services, En Route/Cruise, Phase 3 (2008–2015)

Phase 2 (2003–2007)

- ATC data link services (CPDLC Build 2) are expanded to include an ATN-compliant message set via very high frequency digital link (VDL-2).

Phase 3 (2008–2015)

- ATC data link services, including CPDLC services, are expanded. VHF digital link (VDL-3) increases the capacity of data link. The introduction of digitized transmission increases the reliability of the communications links.

6. Increased Digital Voice and Data Communications Between Service Providers and Pilots, Air Traffic Services, Oceanic

Figure D-24 shows Phase 1 of this capability.

Phase 1 (1998–2002)

- Pilots provide voice messages, including position reports, to oceanic service providers through a communications service provider operator.
- A communications service provider provides two-way data link between the pilot and controller.
- Multisector oceanic data link provides controllers and pilots the ability to exchange digital data messages throughout oceanic airspace.

Phase 2 (2003–2007)

- No additional change in capability.

Phase 3 (2008–2015)

- Same functionality as En Route/Cruise.

6. Increased Digital Voice and Data Communications Between Service Providers and Pilots, Air Traffic Services, NAS-Wide

Figure D-25 shows Phase 3 of this capability.

Phase 1 (1998–2002)

- No change in capability.

Phase 2 (2003-2007)

- No change in capability.

Phase 3 (2008-2015)

- Digital voice and data communications between service providers and pilot using CPDLC Build 3 via VDL-Mode 3 increase.

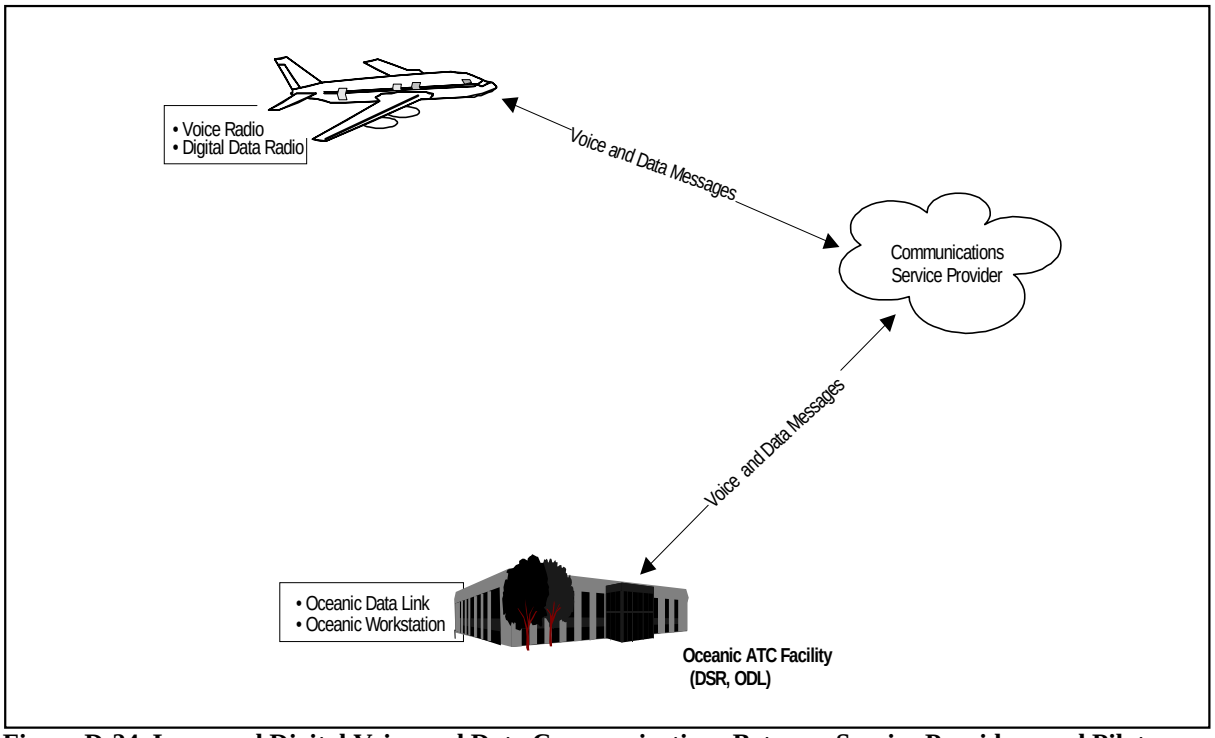

Figure D-24. Increased Digital Voice and Data Communications Between Service Providers and Pilots, Air Traffic Services, Oceanic, Phase 1 (1998–2002)

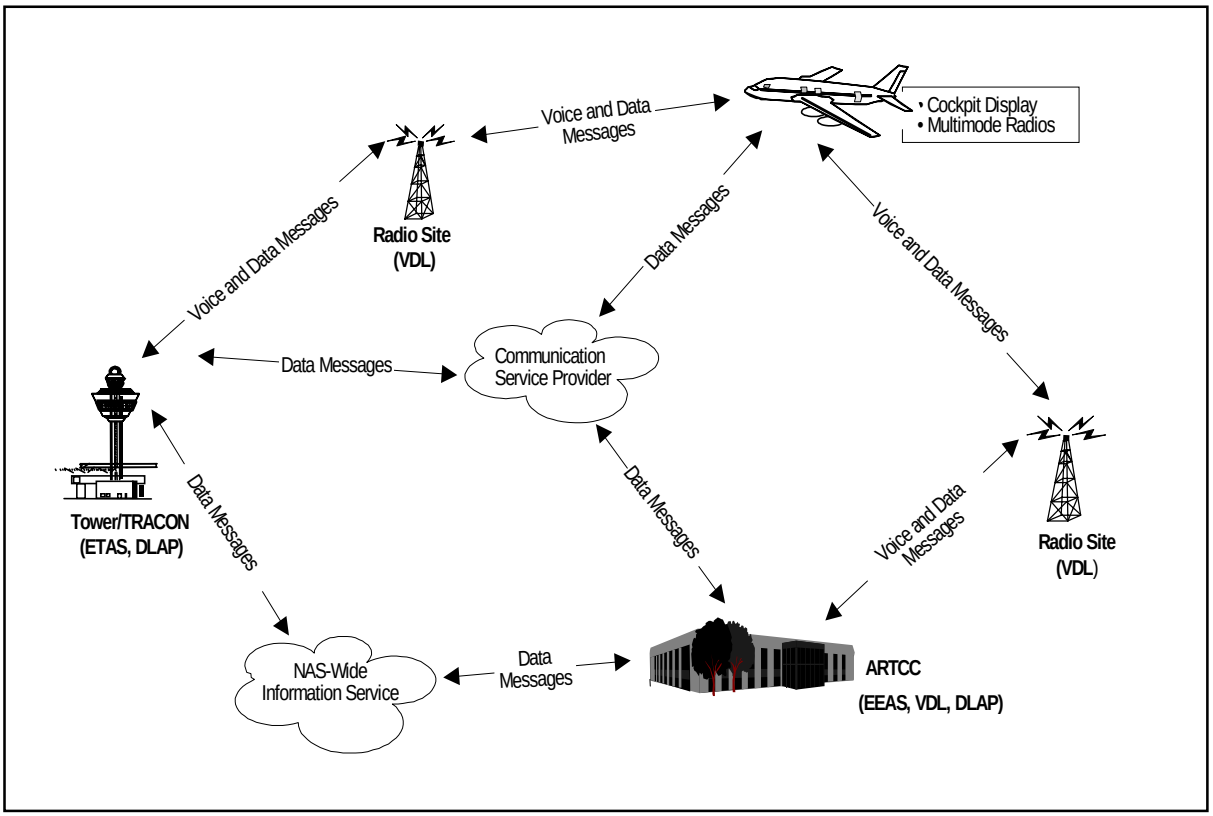

Figure D-25. Increased Digital Voice and Data Communications Between Service Providers and Pilots, Air Traffic Services, NAS-Wide, Phase 3 (2008–2015)

- Service providers and pilots directly exchange digital messages, such as flight information service (FIS) and Traffic Information Service (TIS) information, throughout the NAS using NAS-wide data link.

7. Improved Flight Plan Negotiation, Air Traffic Services, NAS-Wide

Figure D-26 shows Phase 3 of this capability.

Phase 1 (1998–2002)

- No change in capability.

Phase 2 (2003–2007)

- No change in capability.

Phase 3 (2008–2015)

- A new flight object replaces the existing flight plan. The flight object is a 4-dimensional interactive flight profile that is continually monitored and updated throughout an aircraft's active flight. The new flight object contains many more fields of information and conforms to international standards.
- The flight object is activated at aircraft pushback from the departure gate and remains active until engine shutdown at the destination airport.
- The enhanced en route automation system (EEAS) and enhanced terminal automation system (ETAS) use the flight object to automatically approve and monitor diverse departure and arrival paths as well as en route flight trajectories. Flight conformance monitoring, conflict detection, and recommended resolutions are fully automated during this time period.

8. Improved Arrival and Departure Sequencing and Spacing for Tactical Traffic Flow, Air Traffic Services, Arrival/Departure

Figures D-27 and -28 show Phases 1 and 3, respectively, of this capability.

Phase 1 (1998–2002)

- Introduction of metering tools introduces automation to assist en route service providers in feeding aircraft to airport approach controls at a predetermined rate.
- The Final Approach Spacing Tool (FAST) assists service providers in sequencing and spacing aircraft in high-density terminal areas.

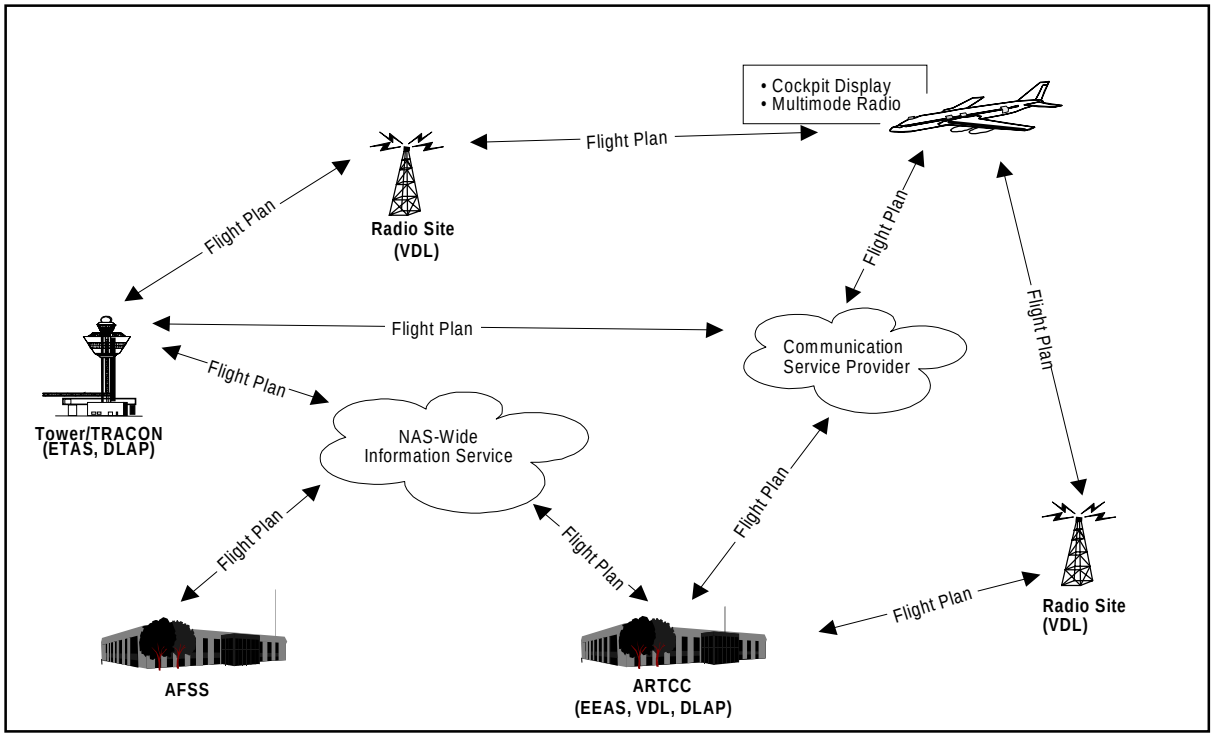

Figure D-26. Improved Flight Plan Negotiation, Air Traffic Services, NAS-Wide, Phase 3 (2008–2015)

PART V

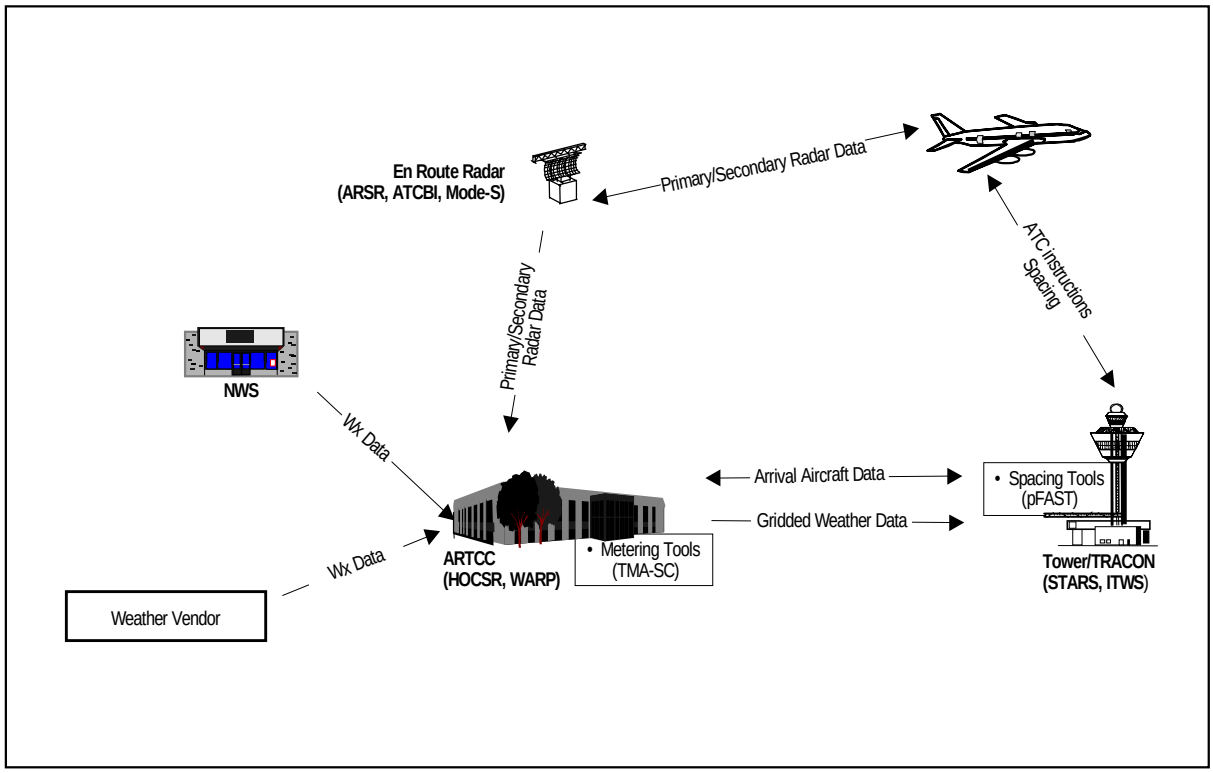

Figure D-27. Improved Arrival and Departure Sequencing and Spacing for Tactical Traffic Flow, Air Traffic Services, Arrival/Departure, Phase 1 (1998–2002)

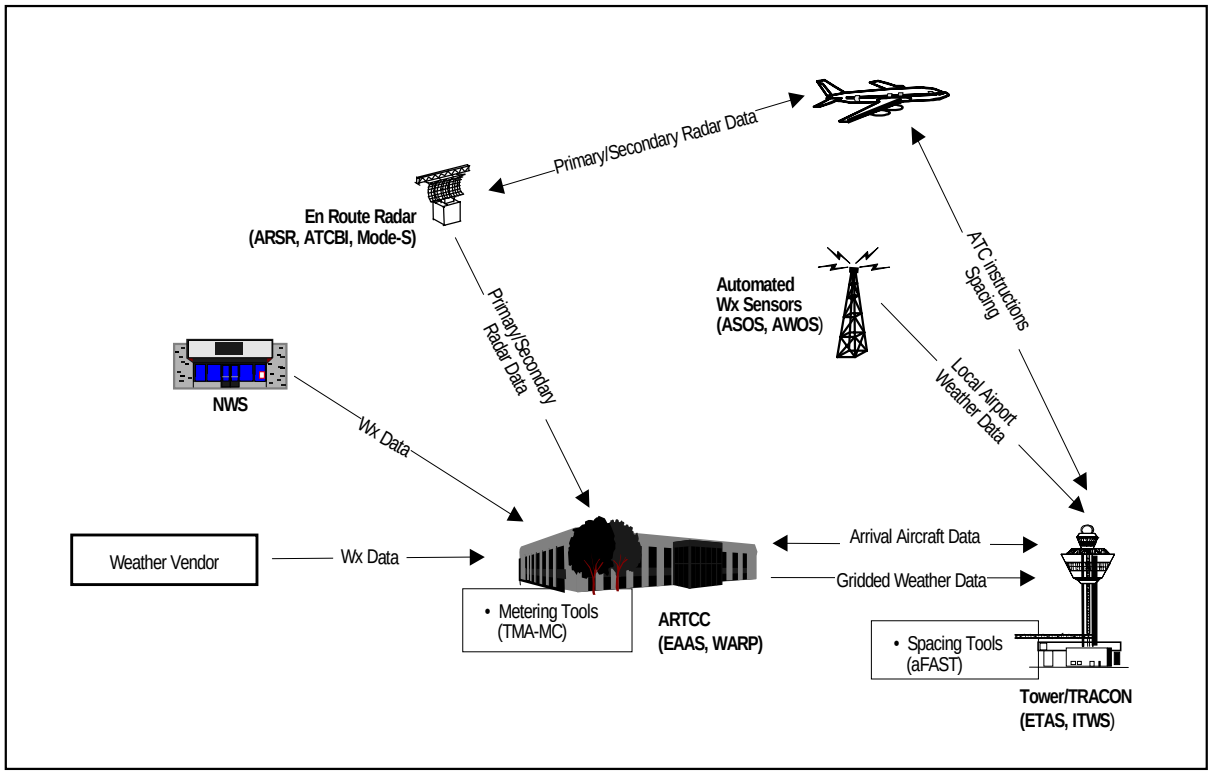

Figure D-28. Improved Arrival and Departure Sequencing and Spacing for Tactical Traffic Flow, Air Traffic Services, Arrival/Departure, Phase 3 (2008–2015)

Phase 2 (2003–2007)

- No additional change in capability.

Phase 3 (2008–2015)

- Enhanced final approach spacing tools incorporate additional parameters (i.e., wake vortex, aircraft performance, user preferences) to fine-tune sequencing and spacing of arriving aircraft.

8. Improved Arrival and Departure Sequencing and Spacing for Tactical Traffic Flow, Air Traffic Services, En Route/Cruise

Figures D-29 and -30, show Phases 1 and 2, respectively, of this capability.

Phase 1 (1998-2002)

- Introduction of metering tools introduces automation to assist en route service providers in feeding aircraft to airport approaches at a predetermined rate.

Phase 2 (2003-2007)

- Air Traffic Management automation tools recommend a course of action to service providers for smoothing traffic flows to maximize airport capacity utilization.
- Multicenter processing of traffic flow increases system capacity utilization.
- Descent advisory tools provide en route service providers recommended tip of "descent points," which makes maximum use of aircraft descent profiles.

Phase 3 (2008-2015)

- No additional change in capability.

9. Increased Flexibility in Flying User-Preferred Routes, Air Traffic Services, En Route/Cruise

Figures D-31, -32, and -33 show Phases 1, 2, and 3, respectively, of this capability.

Phase 1 (1998–2002)

- User request evaluation tool (URET) is available at several facilities to assist controllers in predicting aircraft-to-aircraft conflicts. The service provider's resolution of detected conflict is communicated to the cockpit via the existing VHF/UHF radio system.

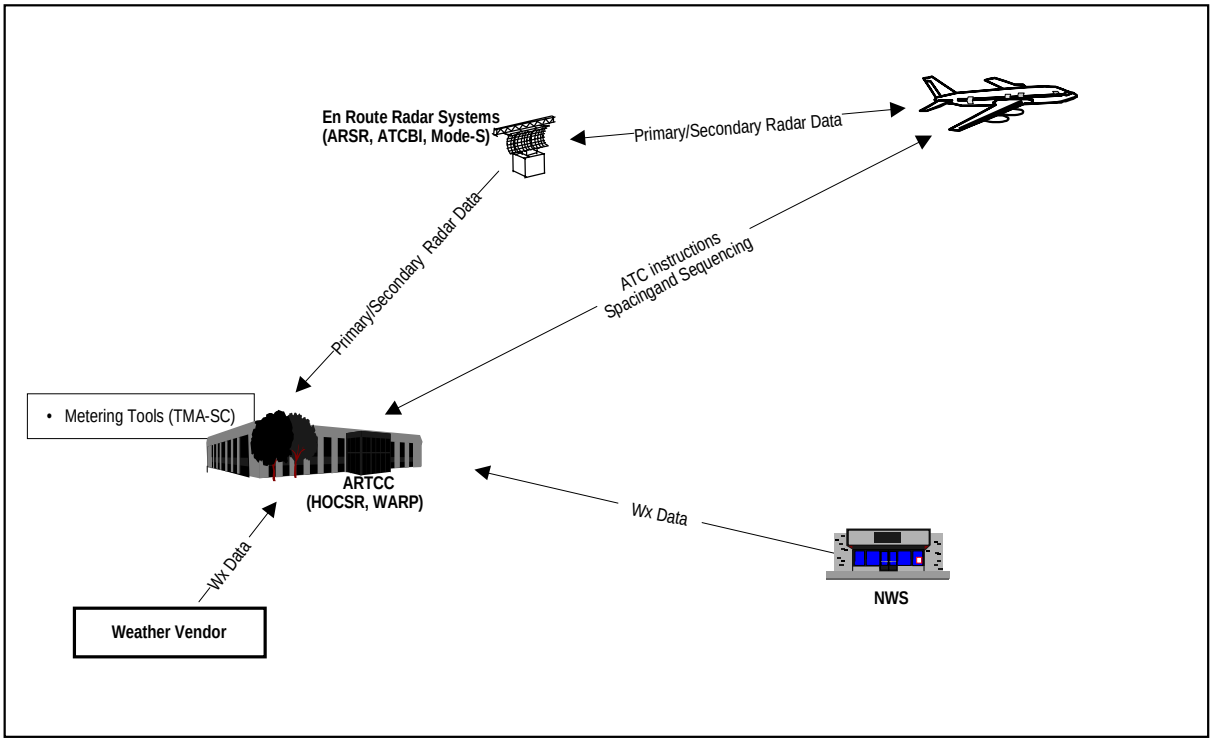

Figure D-29. Improved Arrival and Departure Sequencing and Spacing for Tactical Traffic Flow, Air Traffic Services, En Route/Cruise, Phase 1 (1998–2002)

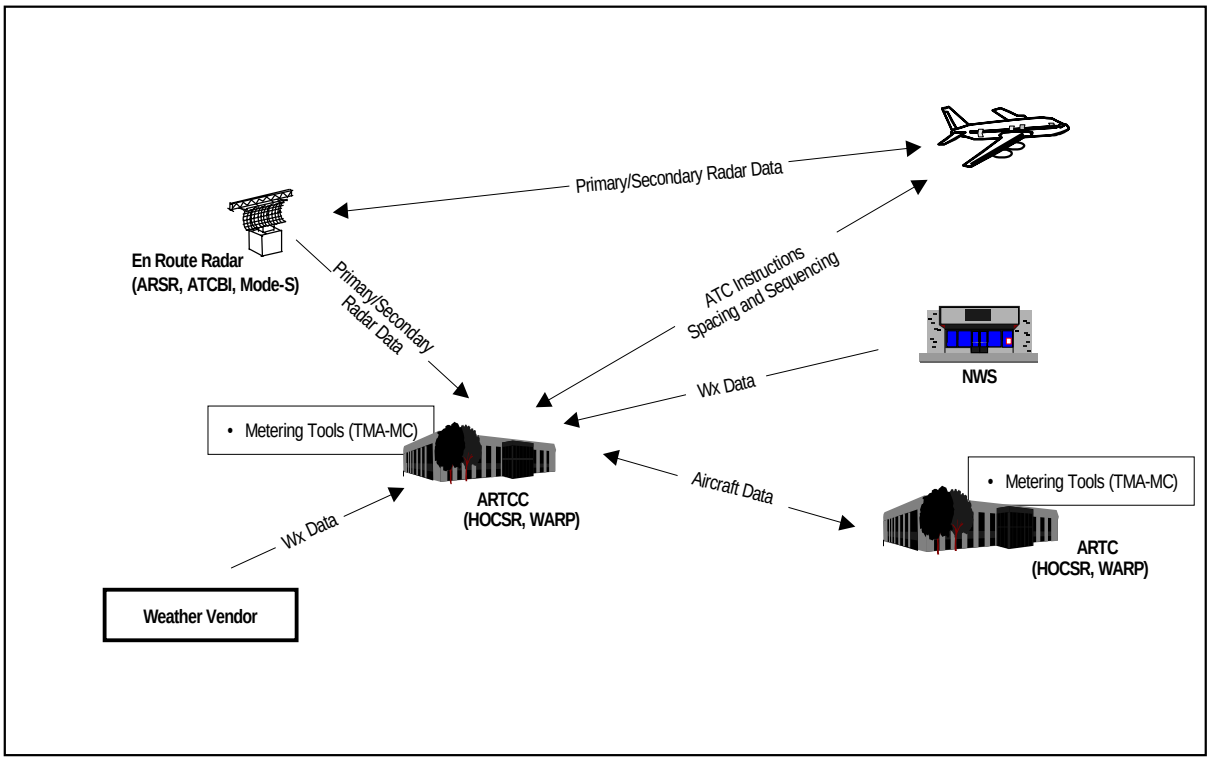

Figure D-30. Improved Arrival and Departure Sequencing and Spacing for Tactical Traffic Flow, Air Traffic Services, En Route/Cruise, Phase 2 (2003–2007)

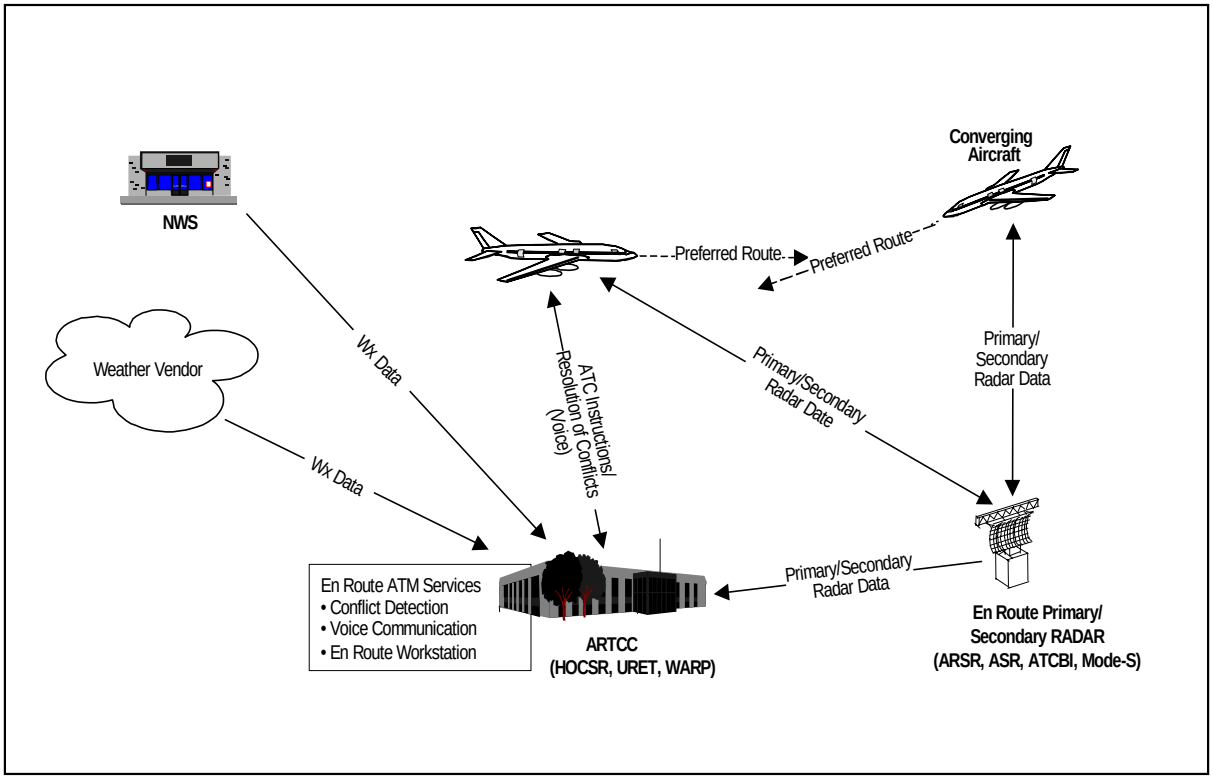

Figure D-31. Increased Flexibility in Flying User-Preferred Routes, Air Traffic Services, En Route/Cruise, Phase 1 (1998–2002)

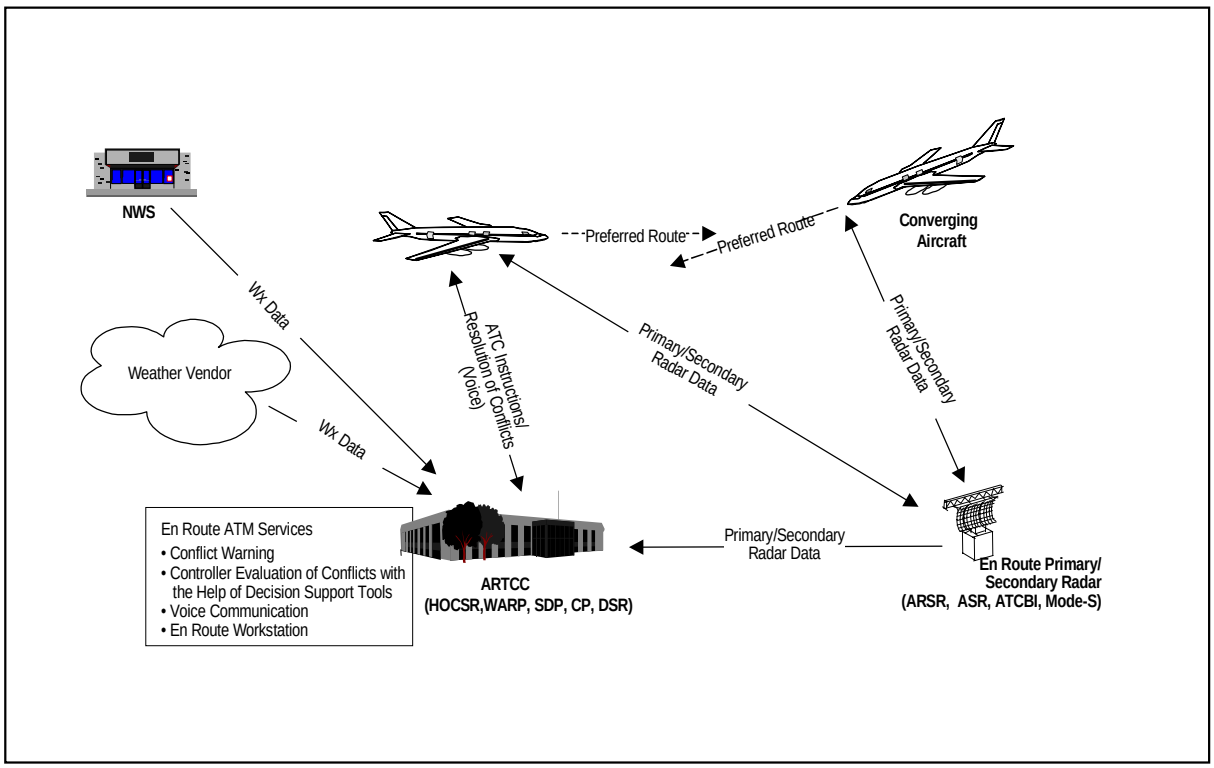

Figure D-32. Increased Flexibility in Flying User-Preferred Routes, Air Traffic Services, En Route/Cruise, Phase 2 (2003–2007)

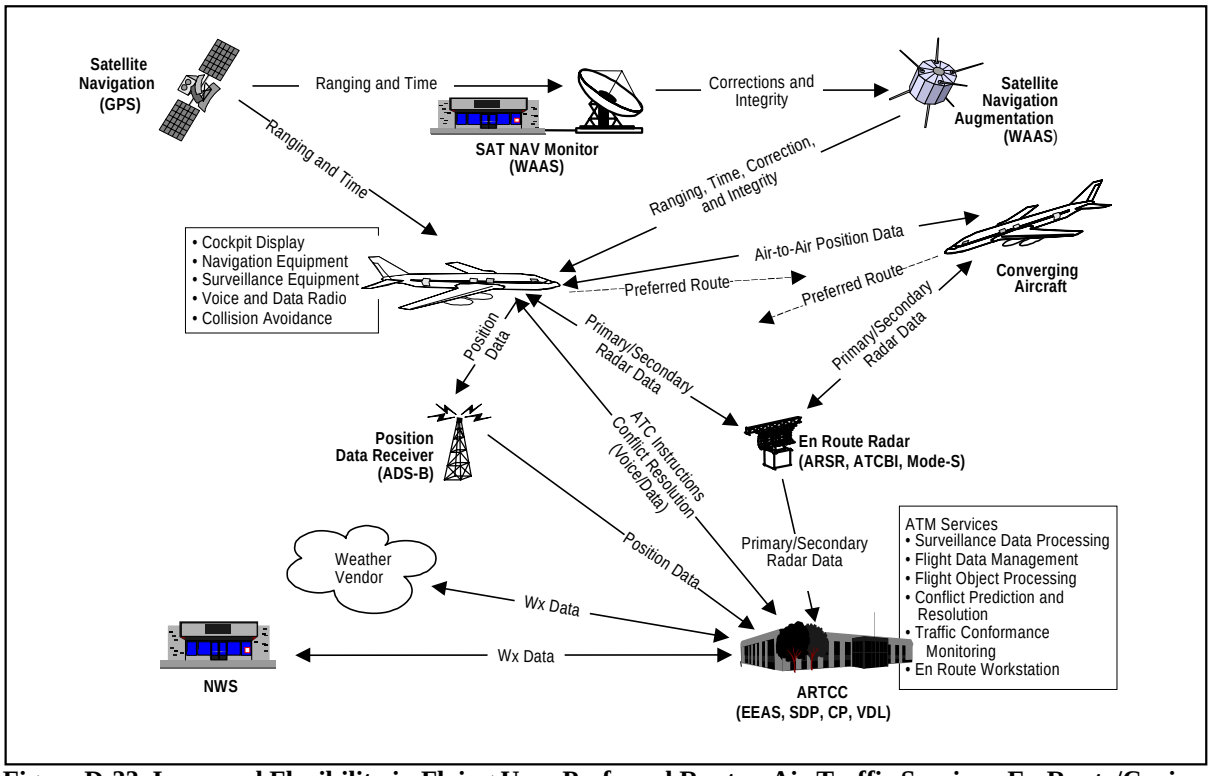

Figure D-33. Increased Flexibility in Flying User-Preferred Routes, Air Traffic Services, En Route/Cruise, Phase 3 (2008–2015)

Phase 2 (2003–2007)

- The ability to predict potential flight conflicts is enhanced by a limited national deployment version of conflict probe to selected sites.

Phase 3 (2008–2015)

- Flight object processing, integrated data link, and ATC/traffic flow management (TFM) decision support system (DSS) applications evolve and are integrated to assist controllers with conflict prediction and recommend actions to avoid the conflict. Conflict probe will be enhanced and deployed nationwide as a conflict probe with multicenter metering and integrated into the en route radar position workstation. The improved conflict probe provides better conflict resolution for evaluation by service providers. Implementation of flight object processing and the NAS-wide information network allows end-to-end checking of aircraft flight paths.

10. Increased Airspace Capacity, Air Traffic Services, Oceanic

Figures D-34 and -35 show Phases 1 and 2, respectively, of this capability.

Phase 1 (1998–2002)

- Reduced vertical separation minimum (RVSM) will allow increased airspace capacity, increased use of optimum altitude profile and increased flexibility of strategic and tactical control.
- RVSM-enabling capabilities involve aircraft avionics (enhanced altimeters, Mode-C transponder, altitude alert system, and automatic altitude hold system).
- Reduction of the separation minima is achieved through improved accuracy and timeliness of ADS-A position reports (from properly equipped aircraft) and enhancements to ground-based automation equipment.
- Air-air position reports provide additional data to enhance pilot awareness of nearby aircraft.
- Addressable automatic dependent surveillance position reports are periodically transmitted to the oceanic automation system via a communications service provider communications link.

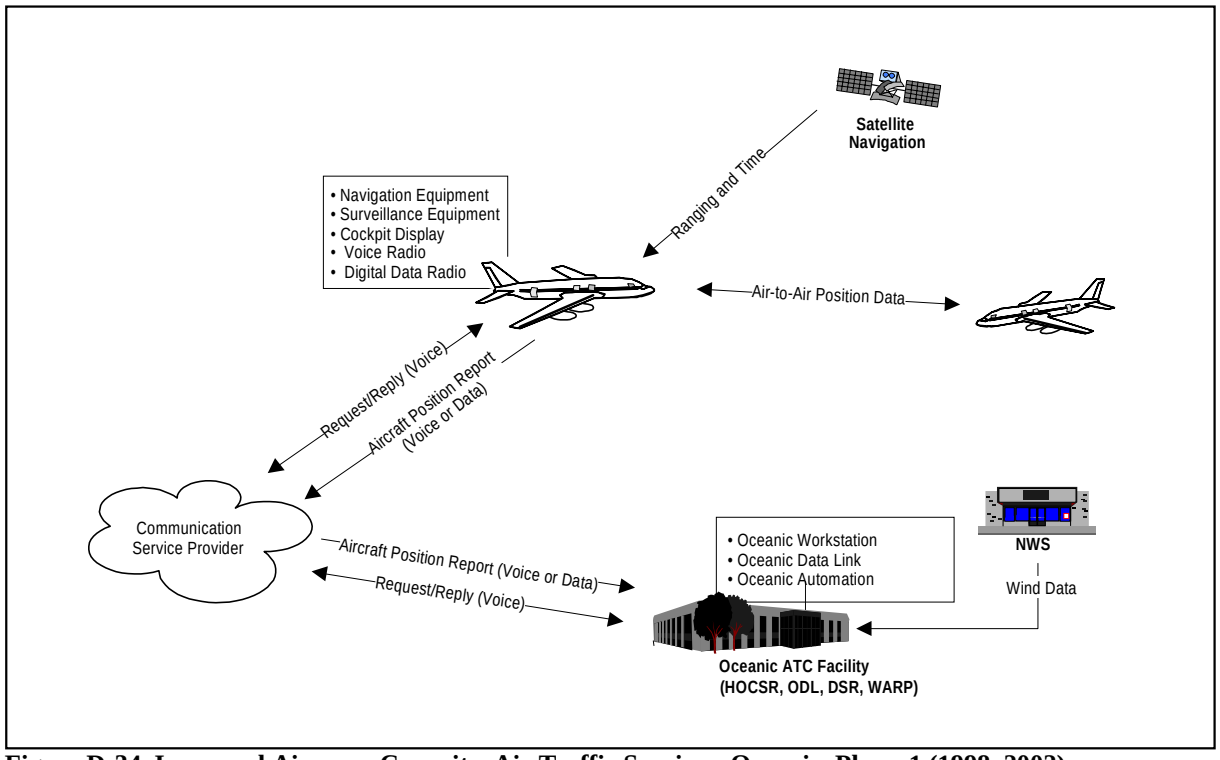

Figure D-34. Increased Airspace Capacity, Air Traffic Services, Oceanic, Phase 1 (1998–2002)

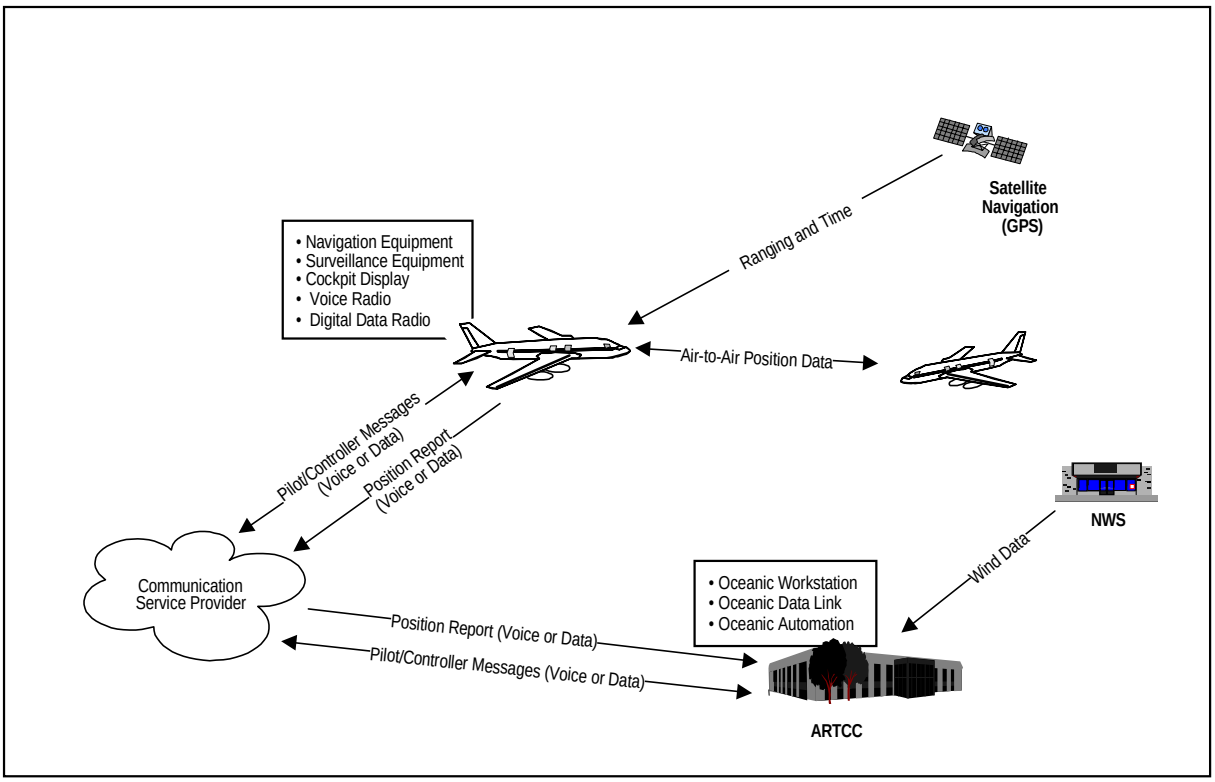

Figure D-35. Increased Airspace Capacity, Air Traffic Services, Oceanic, Phase 2 (2003–2007)

- Oceanic automation uses updated wind data to identify optimal tracks, while projecting aircraft movement to identify airspace competition and availability.

Phase 2 (2003–2007)

- Two-controller access provides oceanic service providers with the capability to distribute traffic workload and handling data-link equipped aircraft during peak traffic times.
- Reduced horizontal separation minimum to 50 lateral, 50 longitudinal will reduce crossing traffic complexity as well as create the potential for more optimum routings to reduce flight time and fuel consumption.
- 50/50 separation requires direct pilot-controller communication, required navigation performance (RNP)-10, and ADS.

Phase 3 (2008–2015)

- Same functionality as En Route/Cruise.

11. Improved Surface Traffic Management, Air Traffic Services, Tower/Airport Surface

Figures D-36,- 37, and -38 show Phases 1, 2, and 3, respectively, of this capability.

Phase 1 (1998–2002)

- As an aircraft approaches the runway, tracks from beacon radar returns are merged with surface radar tracks to automatically associate the track with the flight identification. The automation function continues to track the aircraft on the airport surface, displaying its position and identification to ground service providers.
- As an aircraft backs away from the boarding gate, the flight identification and surface surveillance returns are associated. The aircraft is tracked and displayed on a surface surveillance display.
- The surface surveillance function displays a map of the airport on the surface surveillance display to help ground service providers monitor the surface situation.
- Taxiway lights and signs (taxiway markers) provide visual guidance to flight crews on the airport surface.

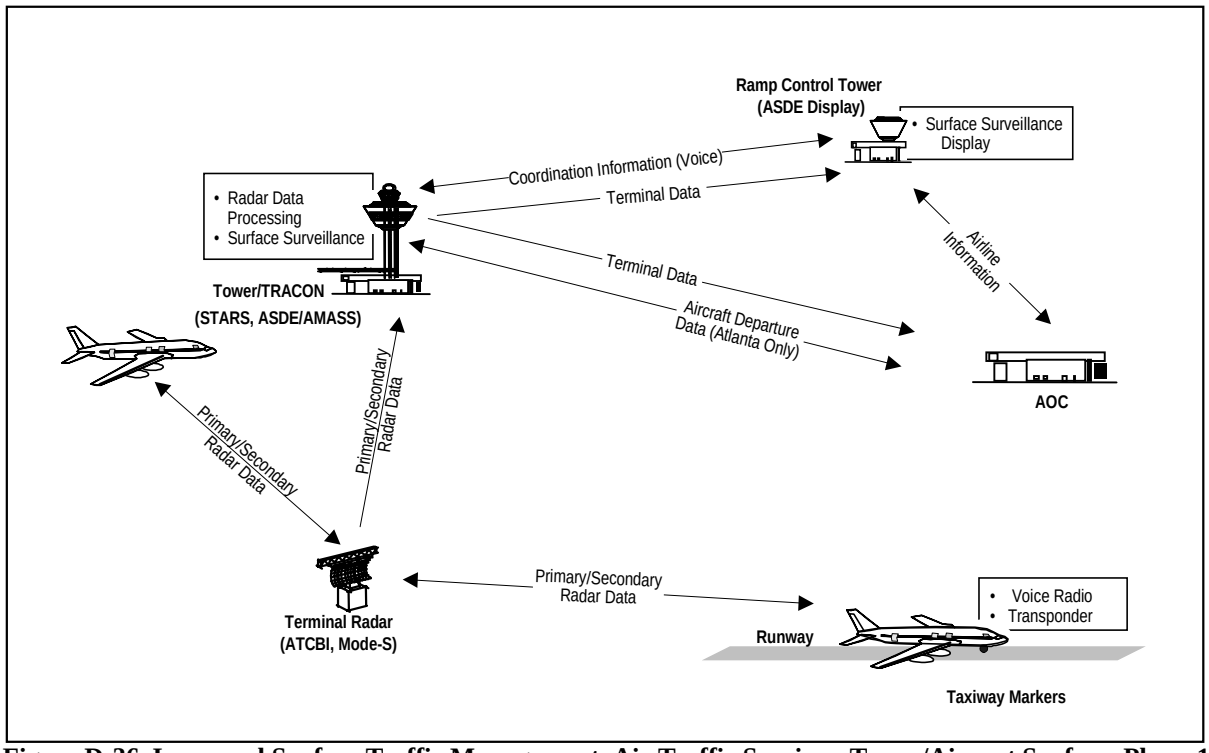

Figure D-36. Improved Surface Traffic Management, Air Traffic Services, Tower/Airport Surface, Phase 1 (1998–2002)

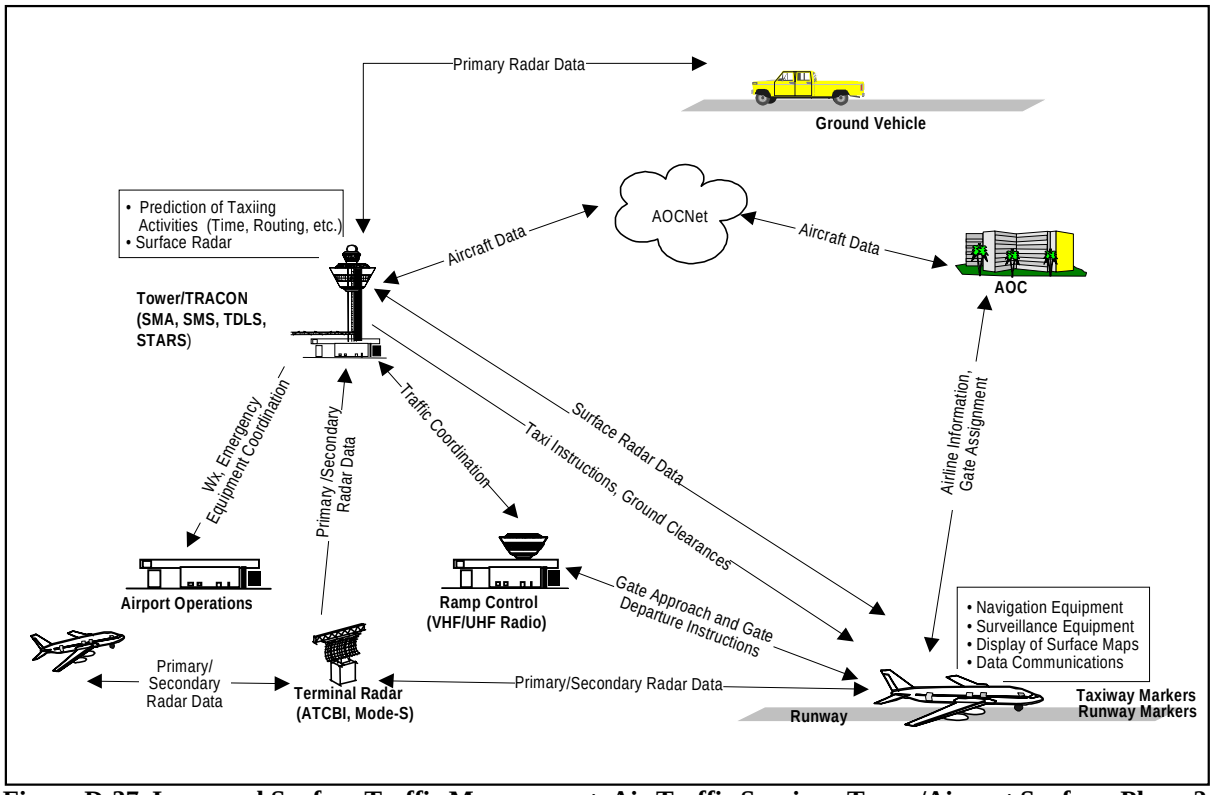

Figure D-37. Improved Surface Traffic Management, Air Traffic Services, Tower/Airport Surface, Phase 2 (2003–2007)

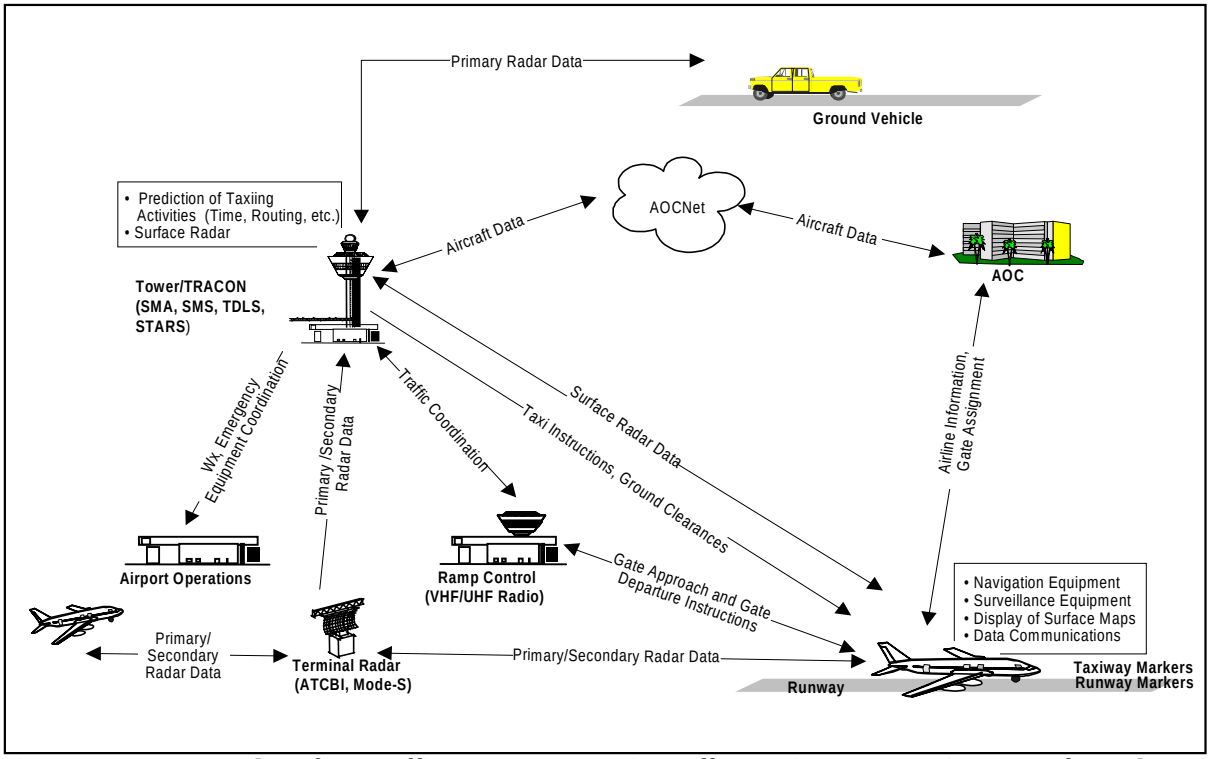

Figure D-38. Improved Surface Traffic Management, Air Traffic Services, Tower/Airport Surface, Phase 3 (2008–2015)

Phase 2 (2003–2007)

- Integrated situation display of airport surface and terminal data assists the service provider in managing the airport area.
- Introducing networking technology in the tower environment significantly decreases the time delay for delivery of critical traffic information to the service providers, airline personnel, and airport operations.

Phase 3 (2008–2015)

- Introducing global positioning local augmentation increases the accuracy of the position data from both surface vehicular and aircraft traffic. The additional data are provided to improve the situational awareness of service providers and pilots. Data fusion further enhances the accuracy of position data presented to the service provider.
- Introducing airport surface maps in the cockpit provides additional data to assist flight crews in improving their situational awareness.

12. Increased Low-Altitude Direct Routes, Air Traffic Services, NAS-Wide

Figures D-39 and -40 show Phases 1 and 2, respectively, of this capability.

Phase 1 (1998–2002)

- Aircraft will navigate direct using WAAS, and its position will be derived, where possible, from en route surveillance radar.

Phase 2 (2003–2007)

- Aircraft will navigate direct using WAAS, and its position will be determined by ATC from either the en route surveillance radar or a terminal radar system.
- Aircraft will navigate direct using WAAS, and its position will be determined from ADS-B.

Phase 3 (2008–2015)

- No additional change in capability.

13. Increased Availability of Aeronautical Information to Service Providers and NAS Users, Air Traffic Services, NAS-Wide

Figure D-41 shows Phase 3 of this capability.

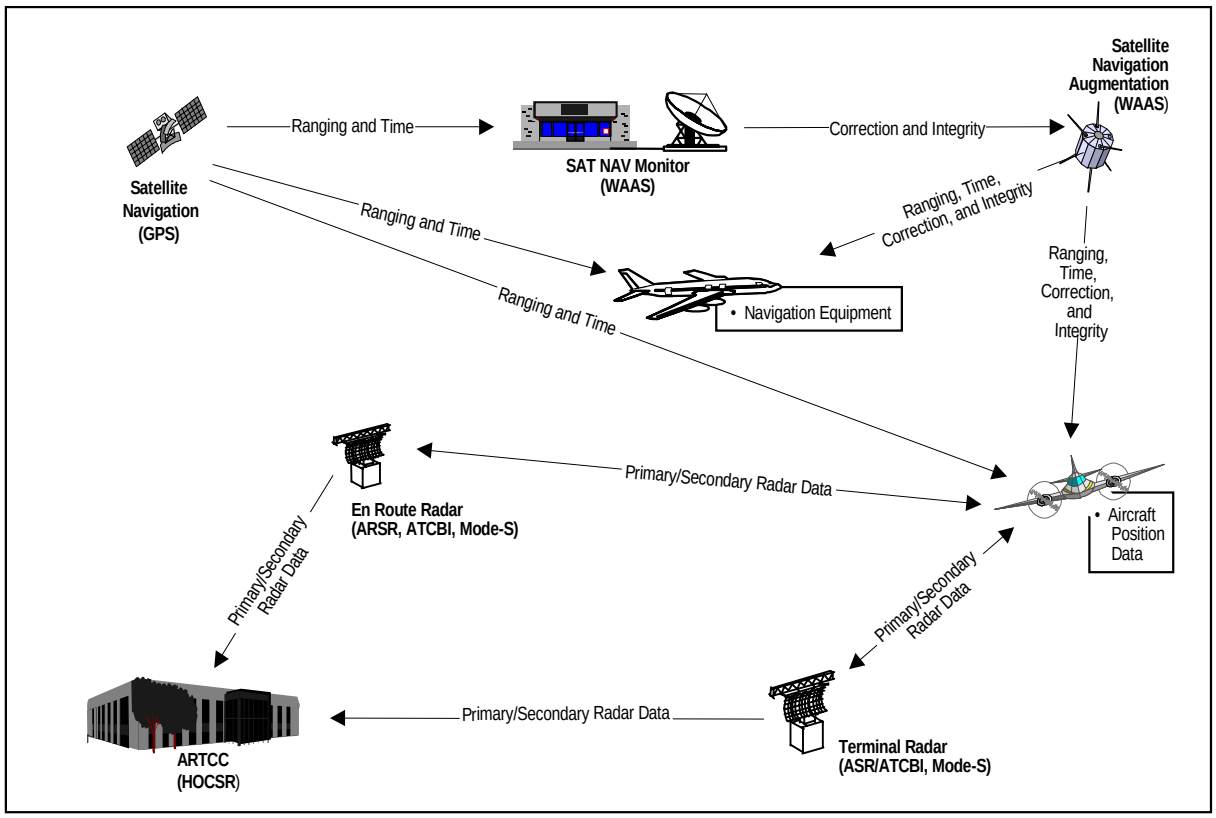

Figure D-39. Increased Low-Altitude Direct Routes, Air Traffic Services, NAS-Wide, Phase 1 (1998–2002)

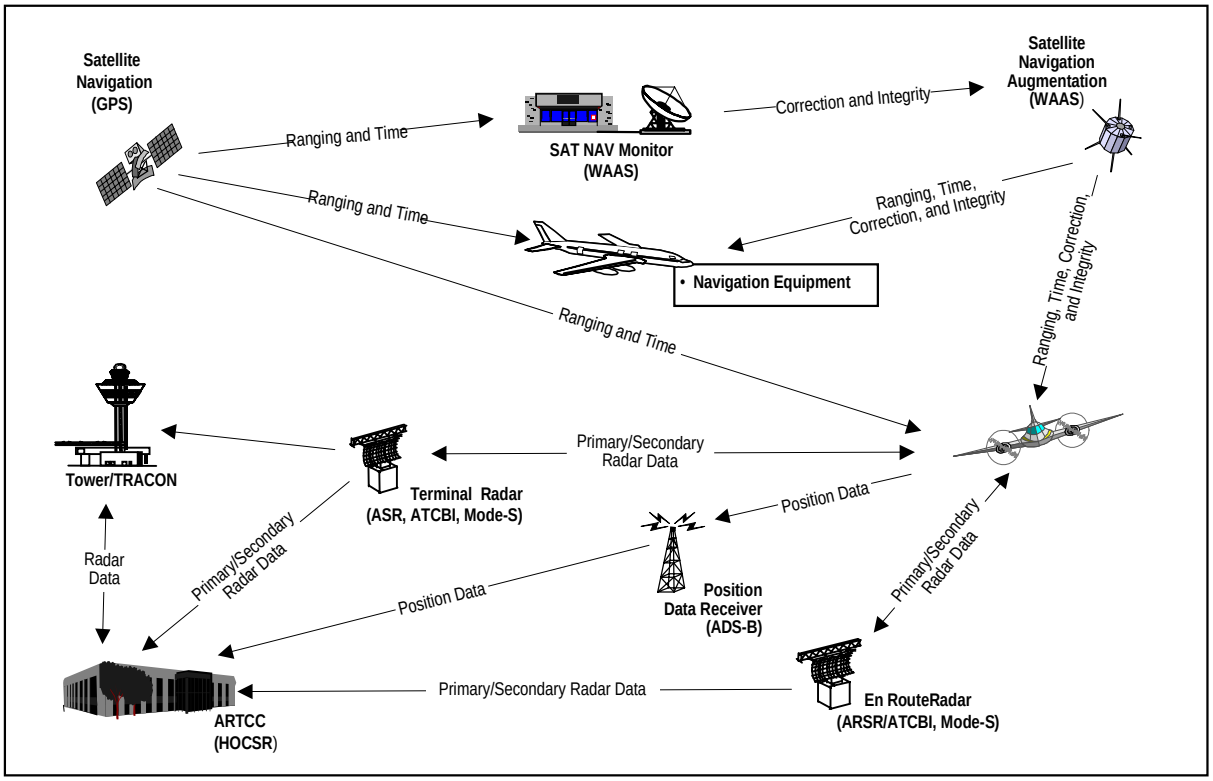

Figure D-40. Increased Low-Altitude Direct Routes, Air Traffic Services, NAS-Wide, Phase 2 (2003–2007)

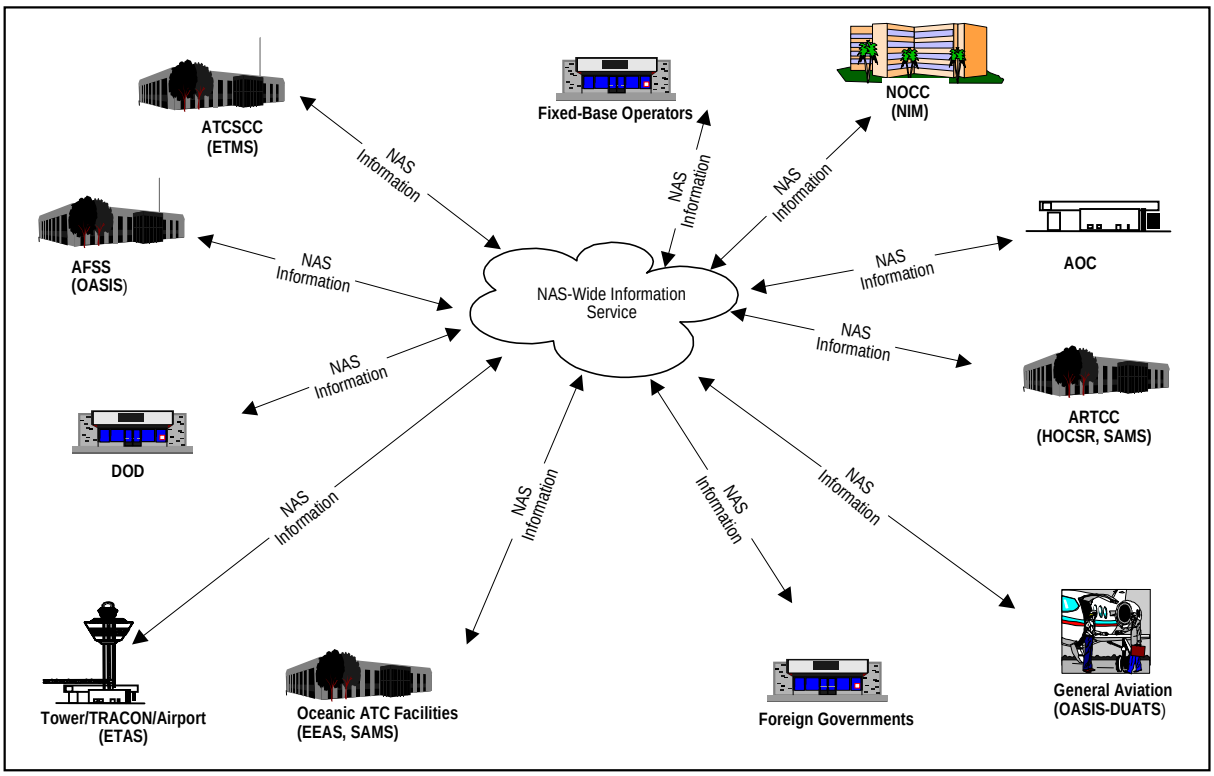

Figure D-41. Increased Availability of Aeronautical Information to Service Providers and NAS Users, Air Traffic Services, NAS-Wide, Phase 3 (2008–2015)

Phase 1 (1998–2002)

- No change in capability.

Phase 2 (2003–2007)

- No change in capability.

Phase 3 (2008–2015)

- A NAS-wide information-sharing system is established to provide real-time exchange of NAS data. The data include NAS operational and maintenance status, weather, FAA facility status, and AOC and DOD operations information.

- Information systems security measures are in place to ensure data integrity.

14. Improved Collaborative Decisionmaking Between Service Providers and NAS Users for Strategic Planning, NAS Management Services, Traffic Management

Figures D-42, -43, and -44 show Phases 1, 2, and 3, respectively, of this capability.

Phase 1 (1998–2002)

- The introduction and integration of traffic management tools significantly enhance the collaborative decisionmaking process.

- As ATC automation tools begin to share strategic traffic flow messages, the collaborative decisionmaking process will mature. The dedicated airline operations network provides schedule information to the ATCSCC. This information can be coordinated with ARTCC and major terminal facilities in real time.

Phase 2 (2003–2007)

- Flight plan evaluation is based on a real-time exchange of data via a local area network (LAN) and a wide area network (WAN) that will provide a rapid two-way exchange of aeronautical information used by strategic planners in the FAA as well as the airlines, private industry, and the DOD.

- NAS flight operations are monitored for real-time compliance, and system-level impact assessments are readily available to all system users.

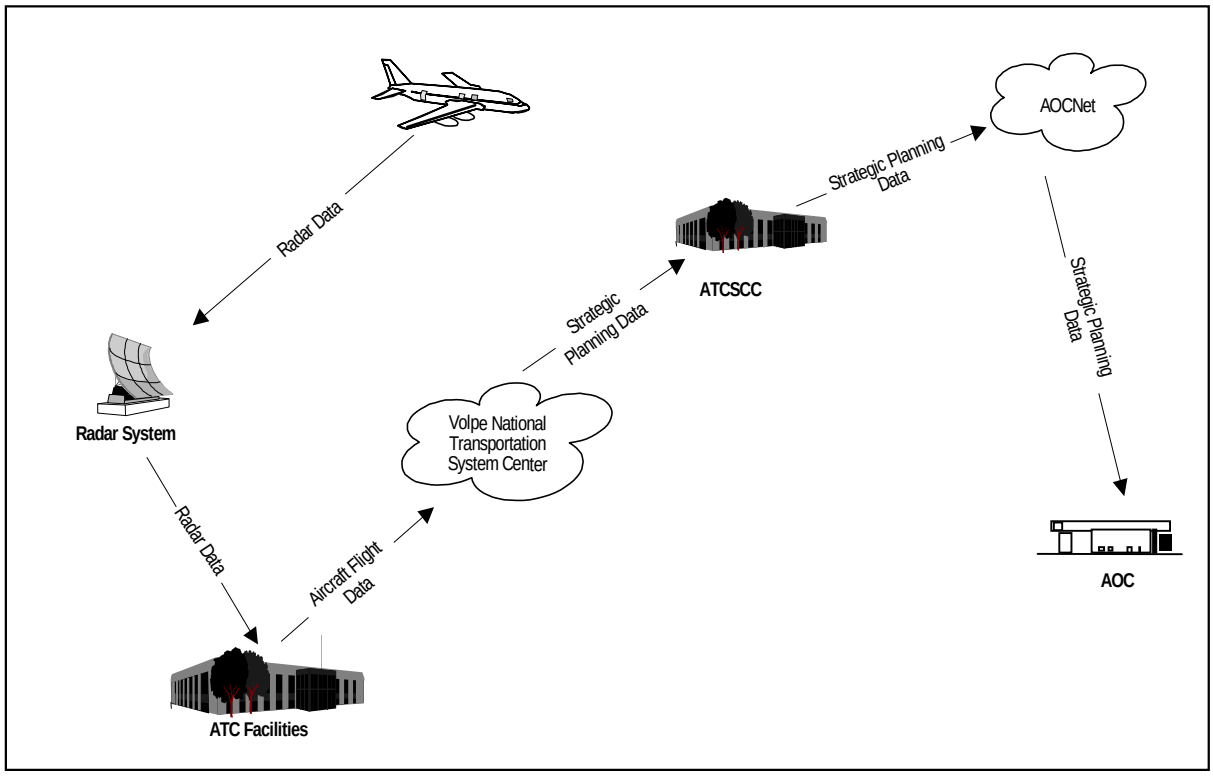

Figure D-42. Improved Collaborative Decisionmaking Between Service Providers and NAS Users for Strategic Planning, NAS Management Services, Traffic Management, Phase 1 (1998–2002)

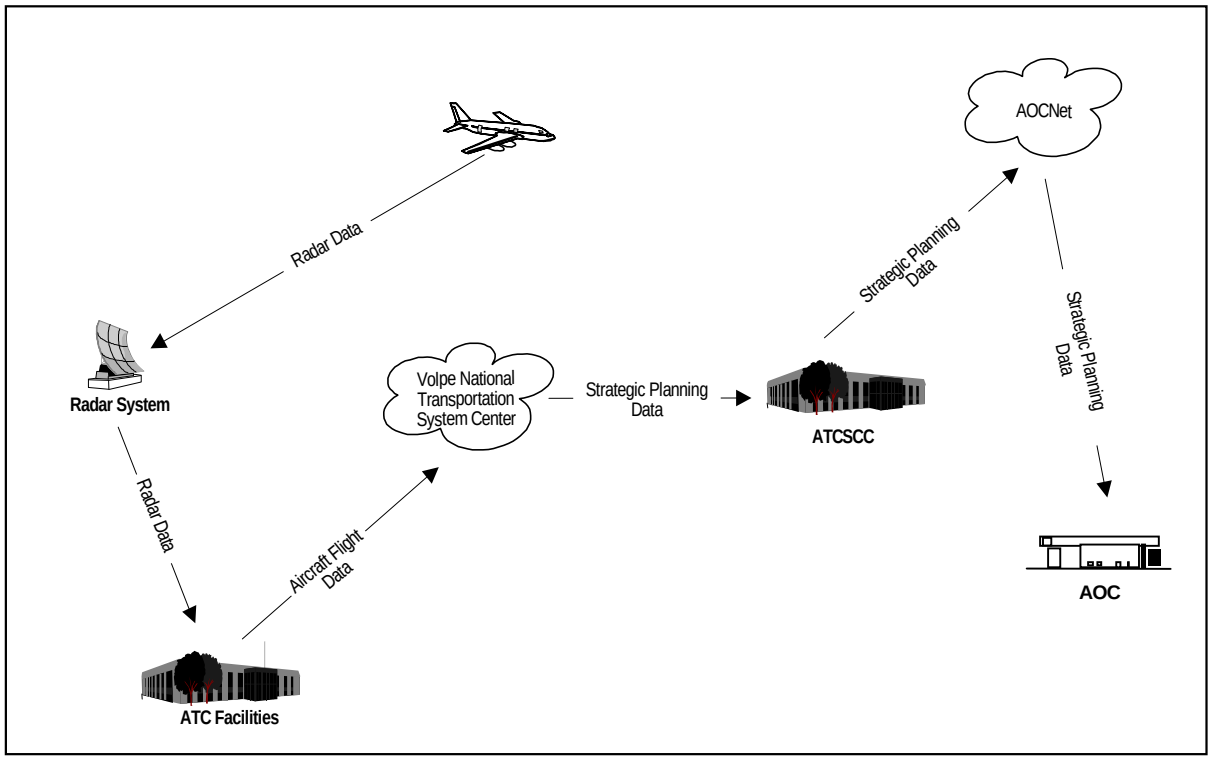

Figure D-43. Improved Collaborative Decisionmaking Between Service Providers and NAS Users for Strategic Planning, NAS Management Services, Traffic Management, Phase 2 (2003–2007)

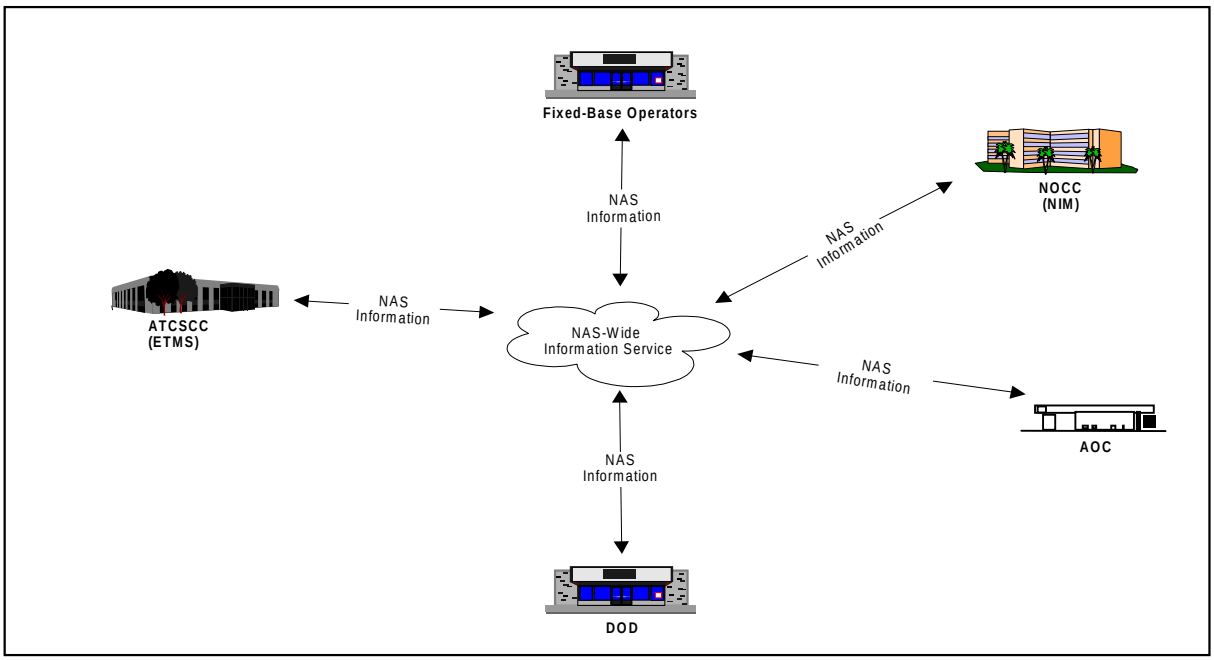

Figure D-44. Improved Collaborative Decisionmaking Between Service Providers and NAS Users, NAS Management Services, Traffic Management, Phase 3 (2008–2015)

- Airline resources effectiveness is increased through closer airline operations center (AOC)/NAS coordination and the ability to evaluate impacts on a fleet basis.

Phase 3 (2008–2015)

- Systemwide CDM provides for a real-time exchange of NAS aeronautical information used by strategic planners in the FAA as well as the airlines, DOD, and private industry.
- Strategic decision support tools use common data sets for data processing and distributing the results to all system users.
- NAS flight operations are monitored for real-time compliance, and system-level impact assessments are readily available to all system users.

15. Increased Ability To Support Search and Rescue Activities, NAS Management Services, NAS Information

Figure D-45 shows Phase 3 of this capability.

Phase 1 (1998–2002)

- No change in capability.

Phase 2 (2003–2007)

- No change in capability.

Phase 3 (2008–2015)

- Aircraft are equipped with satellite navigation and emit a 406 MHz signal that will be detected by one or more satellites, which then relay the aircraft positions to the National Oceanic and Atmospheric Administration (NOAA). The aircrafts' downed positions are then transmitted to the rescue coordination center.
- Normal emergency frequencies are monitored 24 hours a day and when they are detected, ATC facilities are notified. Once a true emergency has been confirmed, flight plan data and last-known position are forwarded to the rescue coordination center.

16. Improved Infrastructure Maintenance Management, NAS Management Services, Infrastructure Management

Figures D-46, -47, and -48 show Phases 1, 2, and 3, respectively, of this capability.

Phase 1 (1998–2002)

- NAS systems are continually monitored for acceptable performance. Reports of anomalies are transmitted to an operations control center (OCC).

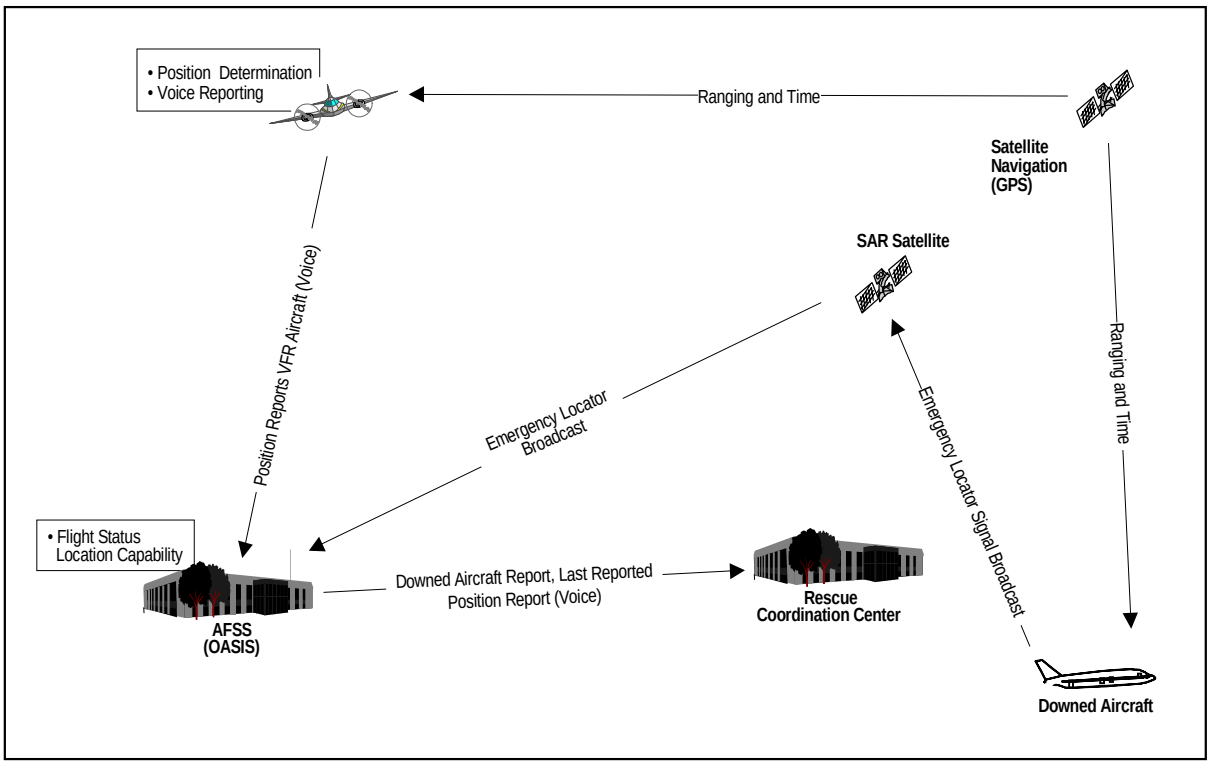

Figure D-45. Increased Ability To Support Search and Rescue Activities, NAS Management Services, NAS Information, Phase 3 (2008–2015)

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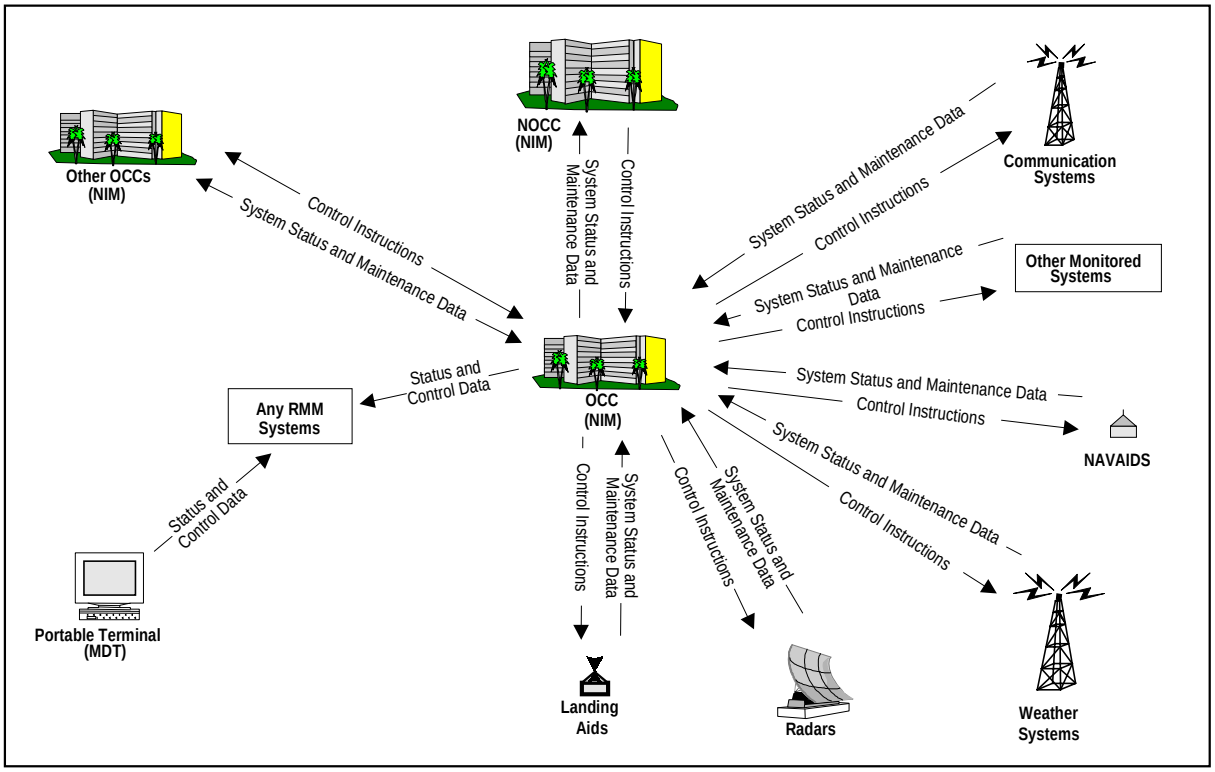

Figure D-46. Improved Infrastructure Maintenance Management, NAS Management Services, Infrastructure Management, Phase 1 (1998–2002)

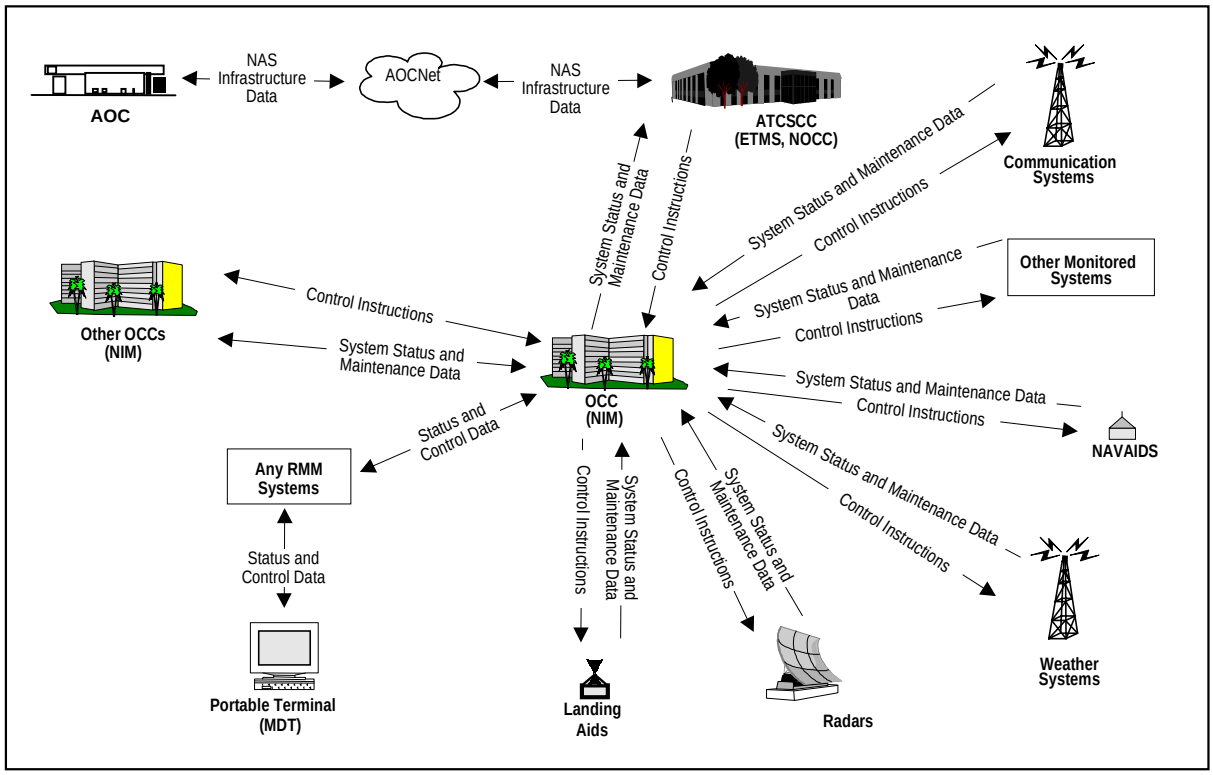

Figure D-47. Improved Infrastructure Maintenance Management, NAS Management Services, Infrastructure Management, Phase 2 (2003–2007)

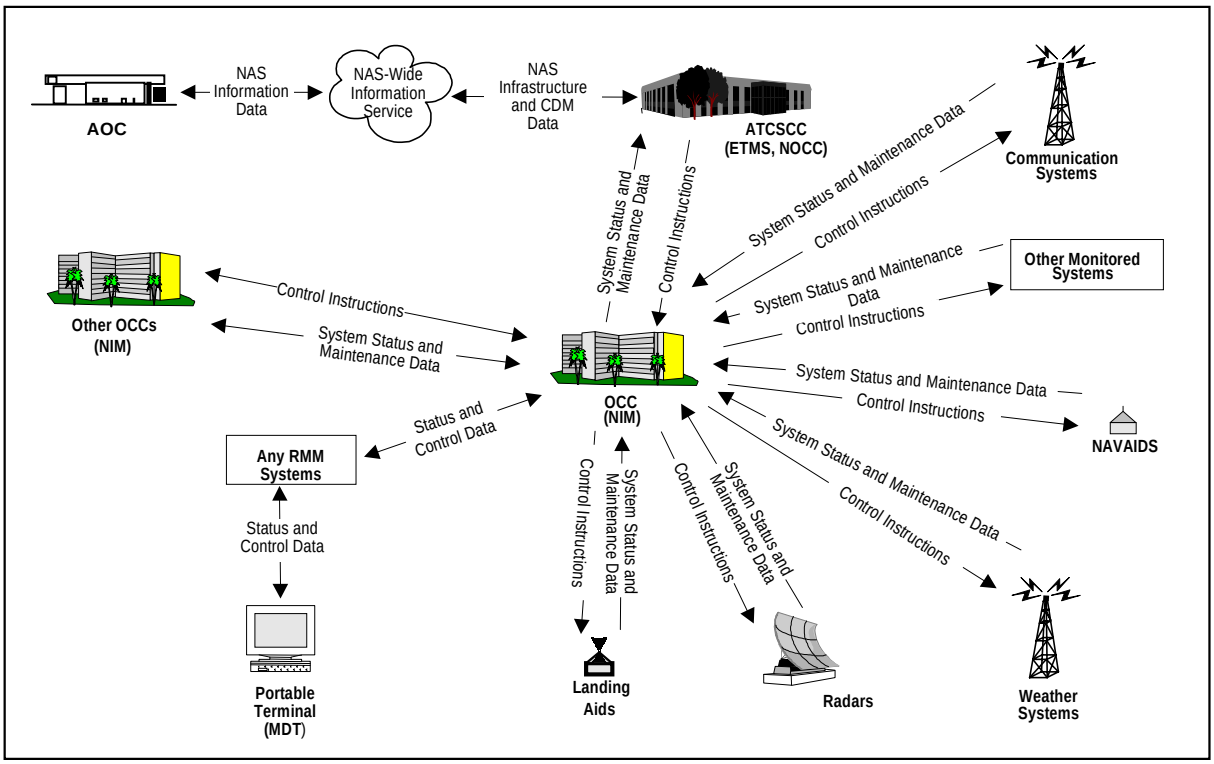

Figure D-48. Improved Infrastructure Maintenance Management, NAS Management Services, Infrastructure Management, Phase 3 (2008–2015)

- During and at completion of maintenance activity, the technician enters data into a maintenance data terminal (MDT) that forwards the information to the OCC for evaluation and storage.

- System status and selected performance parameters are periodically provided to the OCC. These parameters can also be read by the National Operations Control Center (NOCC) upon request.

- System status reports are sent from all OCCs to the NOCC for NAS impact evaluation and input to the traffic management operation.

- Selected systems accept configuration change instructions through the remote maintenance sensor (RMS) function (e.g., radar channel changes).

Phase 2 (2003–2007)

- As more NAS systems are monitored, the NAS facility status data become more accurate and available to users and service providers.

- CDM for maintenance activities allows for limited collaboration with users for scheduled maintenance activities.

Phase 3 (2008–2015)

- Improved CDM for maintenance activities allows for expanded collaboration with users for scheduling maintenance activities.

D.2 Capability Matrix

The capability matrix is divided into two parts. Part one addresses air traffic service capabilities throughout the active phase of flights. Part two addresses NAS management services that cross domains of flight or involve infrastructure management issues.

The matrix lists the 16 top-level capabilities identified in the NAS concept of operations (CONOPS). Each capability is addressed by phase of flight and phase of the modernization plan. The matrix columns contain functions needed to achieve the desired capability. The bold italic text is the commonly used name of the capability.

Table D-1. NAS Modernization Capabilities – Air Traffic Services

Capability	Tower/Airport Surface	Arrival/Departure	En Route/Cruise	Oceanic	NAS-Wide (Multiple Domains of Flight)
1. Increased Navigation/Landing Position Accuracy and Site Availability					
Phase 1.	No change in capability	***Initial WAAS Precision Approach Existing Airports*** Provides WAAS precision approaches to airports that currently have existing Category I or other approaches; actual approach minima will continue to be based on obstacle clearance, lighting, etc. ***Initial WAAS Precision Approach New Qualifying Airports*** Provides WAAS precision approaches to airports that currently do not have precision approaches; actual approach minima will continue to be based on obstacle clearance, lighting, etc.	No change in capability	***GPS Oceanic*** Provides pilots an additional, more precise and reliable means to determine aircraft position	***Terrain Avoidance*** Provides GPS-based vertical reference; provides pilots with enhanced ground proximity warning ***Initial WAAS Cruise*** Provides area navigation capability
Phase 2.	No change in capability	***LAAS CAT I*** Provides LAAS Category I precision approaches to airports not adequately covered by WAAS ***LAAS CAT II, III*** Provides LAAS Category II/III precision approaches to airports	No change in capability	No additional change in capability	No additional change in capability
Phase 3.	No change in capability	No additional change in capability	No change in capability	***Transition to En Route/Cruise***	No additional change in capability
2. Increased Exchange of Common Weather Data					
Phase 1.	Not applicable	***ITWS Stand-Alone*** Consolidates terminal weather information onto a single stand-alone display available to the controller for windshear and other hazardous weather information ***Initial TWIP*** Provides in-flight graphical terminal weather information to pilots based on TDWR data relayed through a service provider; this service is primarily for commercial carriers ***Expanded TWIP*** Provides in-flight graphical terminal weather information to pilots during flight based on data relayed through a service provider; this service is primarily for commercial carriers	***Weather on DSR*** Consolidates weather data onto the en route controller workstation, DSR; this enables selected LRR decommissioning ***Terminal Weather Exchange*** Provides a common weather data picture among the Traffic Management Specialist, terminal, and en route controllers	No change in capability	***MDCRS*** Enables the collection of real-time airborne weather data from participating aircraft and then integrates this collected data with other NAS weather products ***Enhanced MDCRS*** Provides collection of real-time airborne weather data, including temperature and humidity, from participating aircraft, and integrates the data with other weather products for NAS-wide distribution ***Initial FIS*** Provides NWS weather information to the pilot through a service provider; this service is primarily for general aviation

Table D-1. NAS Modernization Capabilities – Air Traffic Services

Capability	Tower/Airport Surface	Arrival/Departure	En Route/Cruise	Oceanic	NAS-Wide (Multiple Domains of Flight)
Phase 2.	Not applicable	***Improved Weather on STARS*** Consolidates terminal weather information onto a single integrated display available to the controller for windshear and other hazardous weather information	No additional change in capability	No change in capability	No additional change in capability
Phase 3.	Not applicable	***Automatic Simultaneous Hazardous Weather Notification*** Provides real-time windshear alert information to pilots	No additional change in capability	***Transition to En Route/Cruise***	No additional change in capability
3. Improved Aircraft Positional Accuracy Reporting to Service Providers					
Phase 1.	***ASDE with AMASS*** Alerts controllers to potential collision situations in the airport movement area at large airports; provides controllers with target identification to aid in the situational awareness ***ASDE*** Provides controllers with primary radar targets to aid in controlling surface traffic and for situational awareness	***Improved Terminal Surveillance (ASTERIX/SI)*** Improved aircraft position accuracy reporting to service providers	No change in capability	No change in capability	No change in capability
Phase 2.	***Runway Incursion Reduction*** Alerts controllers to potential collision situations in the airport movement areas for qualifying airports that do not have ASDE/AMASS; improves airport markings, signage, and lighting; improves the training for pilots about runway signage, lights, and markings	***Integrated Terminal Surveillance with ADS-B*** Provides controllers better position information about air traffic based on GPS; this is an intermediate step toward active FAST	***Improved En Route Surveillance (ASTERIX/SI)*** Improved aircraft position accuracy reporting to service providers ***Integrated En Route Surveillance with ADS-B*** Provides controllers better position information for air traffic based on GPS	No change in capability	No change in capability
Phase 3.	***Integrated Tower Area Surveillance*** Provides controllers better position information about the air traffic based on GPS; also provides controllers integrated information about the arriving aircraft and airport surface aircraft	No additional change in capability	No additional change in capability	***Transition to En Route/Cruise***	No change in capability

Table D-1. NAS Modernization Capabilities – Air Traffic Services

Capability	Tower/Airport Surface	Arrival/Departure	En Route/Cruise	Oceanic	NAS-Wide (Multiple Domains of Flight)
4. Increased Self-Separation by Properly Equipped Aircraft					
Phase 1.	Not applicable	No change in capability	No change in capability	No change in capability	***Air-Air ADS-B*** Provides pilots a cockpit display of traffic information of other properly equipped ADS-B aircraft ***TIS via Mode-S*** Provides air traffic surveillance information to properly equipped in-flight aircraft using Mode-S
Phase 2.	Not applicable	No change in capability	No change in capability	No change in capability	No additional change in capability
Phase 3.	Not applicable	No change in capability	No change in capability	***Transition to En Route/Cruise***	No additional change in capability
5. Increased Surveillance Area Coverage					
Phase 1.	Not applicable	No change in capability	No change in capability	No change in capability	No change in capability
Phase 2.	Not applicable	No change in capability	***Enhanced En Route Radar Coverage*** Provides en route controllers with terminal radar data, thereby covering some areas where ARTCC radar service does not presently exist ***ADS-B Gap-Filler*** Provides controllers with expanded ability to offer separation services in remote areas that are currently not covered by radar, by providing the controllers the ability to receive aircraft position broadcasts	***Oceanic Surveillance via ADS-A*** Provides controllers more timely and more accurate position information about oceanic aircraft	No change in capability
Phase 3.	Not applicable	No change in capability	No additional change in capability	***Transition to En Route/Cruise***	No change in capability
6. Increased Digital Voice and Data Communications Among Service Providers and Pilots					
Phase 1.	***TDLS*** Provides predeparture clearance and ATIS via service provider data link at a limited set of airports.	No change in capability.	***CPDLC Build 1*** Provides lead-in test period that allows controllers and pilots to directly exchange a limited set of data link non-time-critical messages in the en route environment ***CPDLC Build 1A*** Provides for national deployment of a limited set (18) of non-time-critical data link messages	***Oceanic Data Link*** Provides controllers and pilots in an initial single sector environment to exchange digital data messages for control purposes in oceanic airspace ***Multisector Oceanic Data Link*** Provides controllers and pilots the ability to exchange digital data messages throughout the oceanic airspace	No change in capability.

Table D-1. NAS Modernization Capabilities – Air Traffic Services

Capability	Tower/Airport Surface	Arrival/Departure	En Route/Cruise	Oceanic	NAS-Wide (Multiple Domains of Flight)
Phase 2.	**Expanded *TDLS*** Provides pilots with predeparture clearance and ATIS via service provider data link at an expanded number of airports; allows specific set of data transmission from tower controller to aircraft	No change in capability	***CPDLC Build 2 via VDL-Mode-2*** Allows ATC and pilots to directly exchange digital messages in non-time-critical situations in the en route environment	No additional change in capability	No change in capability
Phase 3.	No additional change in capability	No change in capability	***CPDLC Build 2 via VDL-Mode-3*** Increased digital voice and data communications between service providers and pilot	***Transition to En Route/Cruise***	***CPDLC Build 3 via VDL-Mode-3*** Increased digital voice and data communications between service providers and pilot ***NAS-Wide Data Link*** Allows controllers and pilots to directly exchange digital messages, such as FIS and TIS information throughout the NAS
7. Improved Flight Plan Negotiation					
Phase 1.	No change in capability	No change in capability	No change in capability	No change in capability	No change in capability
Phase 2.	No change in capability	No change in capability	No change in capability	No change in capability	No change in capability
Phase 3.	No change in capability	No change in capability	No change in capability	***Transition to En Route/Cruise***	***Interactive Airborne Refile*** Provides in-flight, electronic exchange and automated processing of flight plan change requests between pilots and controllers for entire route clearance
8. Improved Arrival and Departure Sequencing and Spacing for Tactical Traffic Flow					
Phase 1.	Not applicable	***pFAST (FFP1)*** Provides terminal controllers new tools to allow better sequencing and runway assignment of aircraft on final approach to congested airports	***Single Center Metering (FFP1)*** Provides the en route controllers and traffic managers with arrival scheduling tools to optimize traffic flow from a single center to a high-activity airport within that center's airspace	Not applicable	No change in capability
Phase 2.	Not applicable	No additional change in capability	***Multicenter Metering with Descent Advisor*** Provides the en route controllers and traffic managers with arrival scheduling tools to optimize traffic flow from multiple centers to a high activity airport near a center's boundary	Not applicable	No change in capability

Table D-1. NAS Modernization Capabilities – Air Traffic Services

Capability	Tower/Airport Surface	Arrival/Departure	En Route/Cruise	Oceanic	NAS-Wide (Multiple Domains of Flight)
Phase 3.	Not applicable	***aFAST with Wake Vortex*** Provides new tools to the controller to allow better sequencing, spacing, and runway assignment of aircraft on final approach to congested airports; includes refined considerations for wake vortex and specific aircraft characteristic algorithms	No additional change in capability	Not applicable	No change in capability
9. Increased Flexibility in Flying User-Preferred Routes					
Phase 1.	Not applicable	Not applicable	***URET CCLD (FFP1)*** Allows D-side controllers to better manage en route traffic with an increased awareness of potential conflict situations; additionally, allows controllers to grant user requests through the use of a trial planning capability; the capability is limited to selected centers and sectors within those centers	No change in capability	No change in capability
Phase 2.	Not applicable	Not applicable	***Conflict Probe*** Allows D-side controllers to better manage en route traffic with an awareness of potential conflict situations; additionally, allows controllers to grant user requests through the use of a trial planning capability; this capability allows additional sites beyond URET CCLD	No additional change in capability	No change in capability
Phase 3.	Not applicable	Not applicable	***Conflict Resolution with Multicenter Metering*** Provides controllers flight plan recommendations as consideration for providing optimum separation services to solve potential conflicts	***Transition to En Route/Cruise***	No change in capability
10. Increased Airspace Capacity					
Phase 1.	Not applicable	Not applicable	No change in capability	***RVSM/50 Lateral*** Enables the controller and the pilot to negotiate passing maneuvers within the oceanic domain	Not applicable
Phase 2.	Not applicable	Not applicable	No change in capability	***50/50*** Provides tools to the controller to enable reduced separation standards to be utilized for properly equipped aircraft	Not applicable
Phase 3.	Not applicable	Not applicable	No change in capability	***Transition to En Route/Cruise***	Not applicable

Table D-1. NAS Modernization Capabilities – Air Traffic Services

Capability	Tower/Airport Surface	Arrival/Departure	En Route/Cruise	Oceanic	NAS-Wide (Multiple Domains of Flight)
11. Improved Surface Traffic Management					
Phase 1.	***Atlanta SMA*** A prototype decision aid for controllers that provides recommended taxi routes for arriving and departing aircraft to optimize surface movement ***Initial SMA (FFP1)*** Provides airport ramp and control operators with a one-way feed of current traffic information not previously available; this availability is at selected airports for participating airlines	Not applicable	Not applicable	Not applicable	Not applicable
Phase 2.	***SMA*** Provides additional tools that provide controllers with recommended taxi routes for arriving and departing aircraft for optimizing surface movement ***SMS*** Provides airport configuration, aircraft arrival/departure status, and airfield ground movement advisories to controllers, dispatchers, and traffic flow managers; it will interface with AMASS and the terminal automation to help controllers coordinate arrival/departure flows with surface movements	Not applicable	Not applicable	Not applicable	Not applicable
Phase 3.	***Enhanced SMS*** Provides additional tools for the exchange of terminal and airport surface data between ATC and AOCs in a manner that supports the efficient movement of aircraft on the airport surface; it will enable users and providers to have access to flight planning, traffic management, arrival/departure, and weather information	Not applicable	Not applicable	Not applicable	Not applicable
12. Increased Low-Altitude Direct Routes					
Phase 1.	Not applicable	Not applicable	No change in capability	Not applicable	***Low-Altitude Direct Routes Using WAAS*** Provides low-altitude direct routes to be flown by WAAS-equipped aircraft

Table D-1. NAS Modernization Capabilities – Air Traffic Services

Capability	Tower/Airport Surface	Arrival/Departure	En Route/Cruise	Oceanic	NAS-Wide (Multiple Domains of Flight)
Phase 2.	Not applicable	Not applicable	No change in capability	Not applicable	***Low-Altitude Direct Routes, Expanded Radar Coverage*** Provides additional low-altitude direct routes in areas that are currently served by radar by integrating revised airspace design and air-ground communications ***Low-Altitude Direct Routes, Expanded Surveillance Coverage*** Provides integrated and expanded surveillance coverage for additional low-altitude direct routes for properly equipped aircraft in nonradar areas
Phase 3.	Not applicable	Not applicable	No change in capability	Not applicable	No additional change in capability
13. Increased Availability of Aeronautical Information to Service Providers and NAS Users					
Phase 1.	No change in capability	No change in capability	No change in capability	No change in capability	No change in capability
Phase 2.	No change in capability	No change in capability	No change in capability	No change in capability	No change in capability
Phase 3.	***Transition to NAS-Wide***	***Transition to NAS-Wide***	***Transition to NAS-Wide***	***Transition to NAS-Wide***	***NAS-Wide Information Sharing*** Provides for the timely and accurate dissemination of NAS information among the aviation community, including international sharing of appropriate flight planning information

Table D-2. NAS Modernization Capabilities – NAS Management Services

Capability	Traffic Management	NAS Information	Infrastructure Management
14. Improved CDM Between Service Providers and NAS Users for Strategic Planning			
Phase 1.	***AOCNET*** An existing information exchange among participating AOCs and the FAA to facilitate traffic management ***Initial CDM*** Provides participating AOCs and the FAA with real-time access to current NAS status information, including infrastructure and operational factors	Not applicable	Not applicable
Phase 2.	***Flight Plan Evaluation*** Provides interactive feedback to NAS users proposed flight plans based on current constraints such as special use airspace and equipment status	Not applicable	Not applicable
Phase 3.	***Full CDM*** Provides more robust interactive feedback to NAS users proposed flight plans based on current constraints such as special use airspace, equipment and facility status, and weather conditions	Not applicable	Not applicable
15. Increased Ability To Support Search and Rescue Activities			
Phase 1.	Not Applicable	No change in capability	Not applicable
Phase 2.	Not Applicable	No change in capability	Not applicable
Phase 3.	Not Applicable	***ELT for SAR and Flight Following*** Provides GPS location information and discrete aircraft identification of downed aircraft through satellite-based communications	Not applicable
16. Improved Infrastructure Maintenance Management			
Phase 1.	Not Applicable	Not Applicable	***Increased RMM*** Provides improved and more consolidated remote monitoring for NAS facilities
Phase 2.	Not Applicable	Not Applicable	***CDM for Maintenance Activity*** Allows for limited collaboration with users for scheduled maintenance activities
Phase 3.	Not Applicable	Not Applicable	***Improved CDM for Maintenance Activities*** Allows for expanded collaboration with users for scheduling maintenance activities